The Heating and Ventilating Magazine

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New Data on Radiator Finishes and Their Effect on Heat Transmission

Details of a Recent Investigation and a Comparison of the Results with Those of the Well-Known Allen Experiments

By William H. Severns,

Assistant Professor of Mechanical Engineering, University of Illinois

THERE is a widespread interest in the effects produced by various radiator finishes upon the amount of heat emitted from steam radiators. The common inquiries concern the relative efficiencies of colored paints or enamels and those of either gold or aluminum bronze.

It is true that changing the radiator finish will change the amount of heat that may be given off by the radiator per unit of time, other conditions being the same. Some finishes applied to the radiating surfaces will increase the amount of heat transmitted, others will reduce it. This change in the quantity of heat emitted is caused by the physical properties of the finish. The color plays only a very small part in the change and may be neglected. The effect is determined by the final texture or physical condition of the radiating surface.

Consecutive tests, with one finish after another applied to the same radiator, have shown that the results for each individual finish are always the same irrespective of what the finish may have been just prior.

The number of coats applied, within reason, has no measurable effect as the last one is the effective one. There is no storage of heat in the paint, enamel, or bronze. The amount of heat given out by conduction and convection is not appreciably changed.

The radiant heat thrown off is the variable and the change is due to the texture or physical condition of the explored radiating surfaces. Certain chemical components, such as pigments and vehicles of enamels or paints, give coatings that change the surface texture of a rough iron surface. These finishes may cause a slight increase or a slight decrease in the amount of heat transmitted as compared with that from a bare iron surface. The effect is not enough to be considered in commercial work.

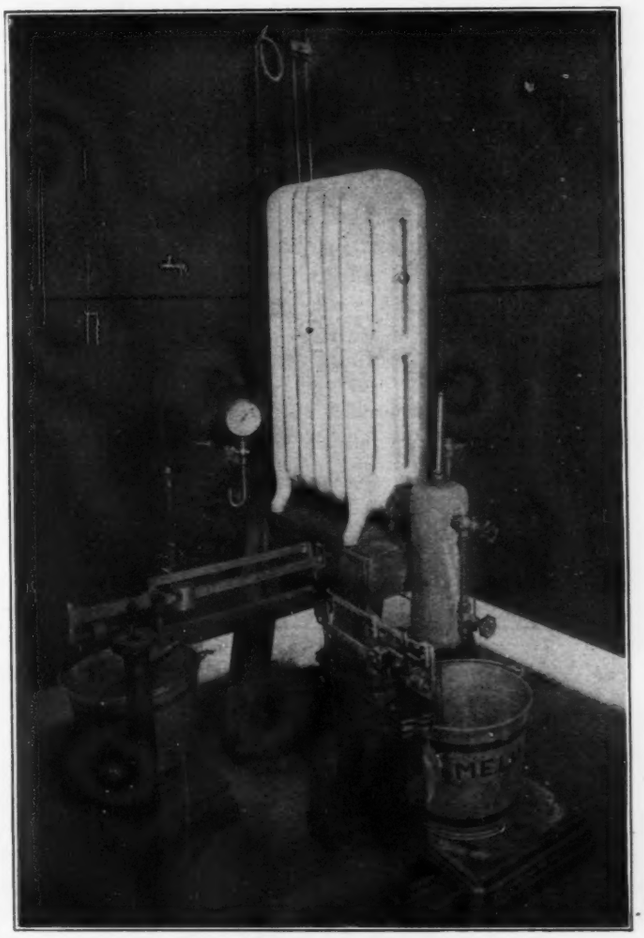


Fig. 1.—Aluminum Bronze Coated Radiator Ready for Testing

Enamels and other pigments mixed with oil as a vehicle will not ordinarily withstand the temperature of steam in many installations. They discolor, blister, and peel and are unsuitable. The gold and aluminum bronzes are durable and form different surface films from those of paints or cause them to produce surfaces unsuited to the enamels. The physical properties of the bronzes cause them to produce surfaces unsuited to the emission of radiant heat. Their effect is to reduce the amount of heat transmitted.

They were 32 in. high, three columns wide, six sections long, and had 27 sq. ft. of radiating surface each. The tests were run under as nearly identical conditions as were possible with respect to the steam and the room temperatures. The steam temperatures ranged from 218° to 220° F., while those of the room varied from 74° to 78°. The radiators were kept in practically still air within similar booths which surrounded each of them. The only movement of air over the hot surfaces was

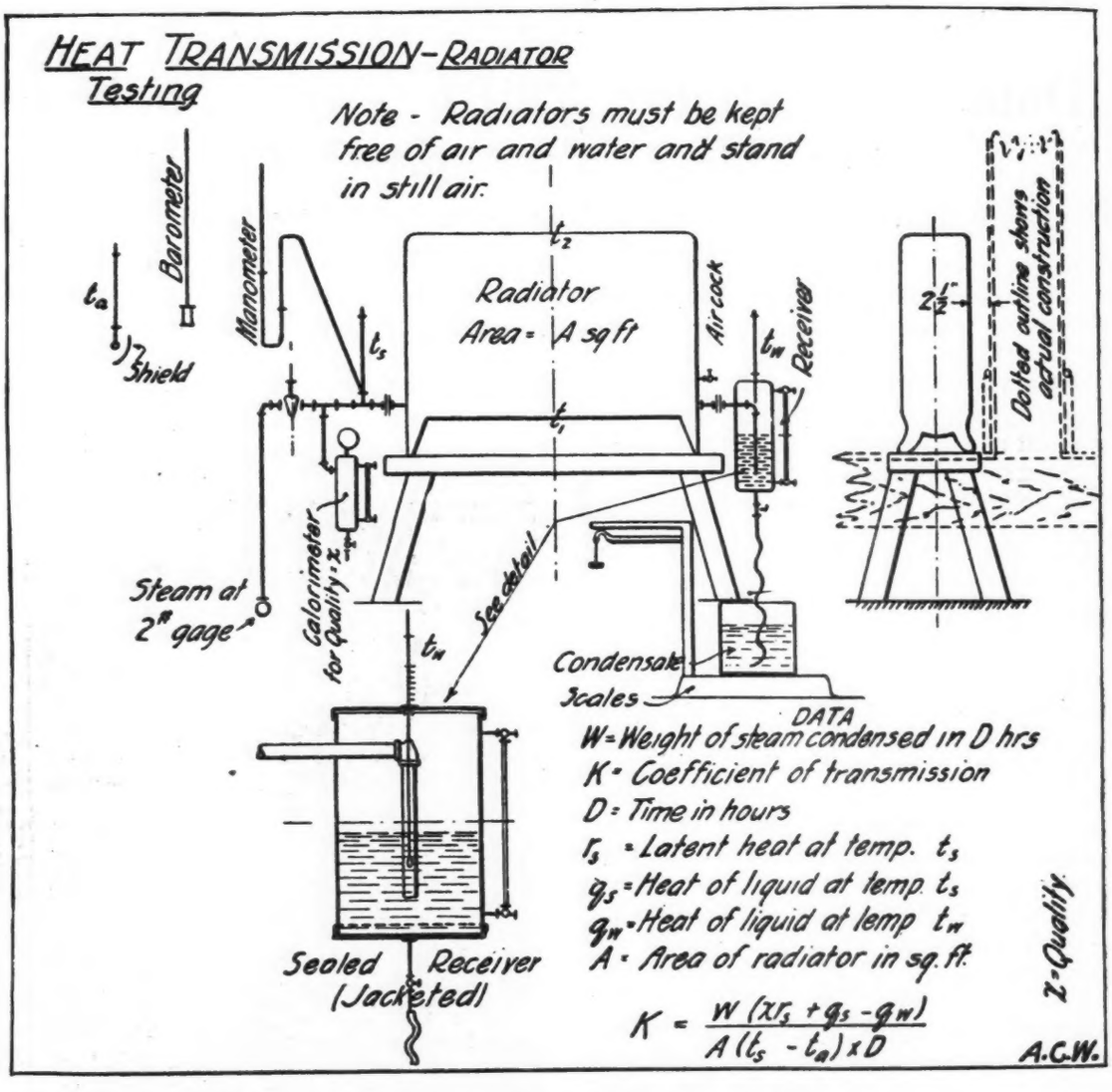

HEAT TRANSMISSION-RADIATOR
Testing
Note - Radiators must be kept free of air and water and stand in still air.
Barometer
Manometer
Shield
Radiator
Area = A sq ft
Air cock
Receiver
Dotted outline shows actual construction
Steam at 2# gage
Calorimeter for Quality - x
See detail
Condensate
Scales
Sealed Receiver (Jacketed)
DATA
W = Weight of steam condensed in D hrs
K = Coefficient of transmission
D = Time in hours
r_s = Latent heat at temp. t_s
q_s = Heat of liquid at temp. t_s
q_w = Heat of liquid at temp t_w
A = Area of radiator in sq. ft.
x = Quality
$K = \frac{W(xr_s + q_s - q_w)}{A(t_s - t_a) \times D}$
A.C.W.

Fig. 2. Diagrammatic Sketch of Radiator Testing Plant

CONDITIONS OF NEW TESTS

Tests have been made by the writer, in the Mechanical Engineering Laboratory at the University of Illinois, to determine the effects of paint or aluminum bronze upon the amount of heat transmission of representative radiators. The test plant used is illustrated in Figs. 1 and 2 and was developed by Professor A. C. Willard, head of the Department of Mechanical Engineering and professor of heating and ventilation at the University of Illinois.

The radiators tested were new and unused. that due to the natural convection currents of the air.

RESULTS OF TESTS

The following results were calculated from the data taken: the coefficient of heat transmission (K), which is the amount of heat in B.T.U. given out per square foot of radiating surface per hour per one degree temperature difference between that of the steam (t_s) and that of the air (t_a) surrounding the radiator: the radiation factor (R) which is equal to K (t_s—t_a) and which is the B.T.U. emitted per square foot of radiating surface per hour: and

the relative transmission values in percent. These results are given in Table 1.

TABLE 1

Radiator No.	Finish	Coefficient of Heat Transmission B.T.U.	Radiation Factor B.T.U.	Relative Heat Transmission Per Cent.
1	Bare iron, free from rust, loose scale, and dirt.	1.77	265.5	100.0
2	Aluminum bronze one coat	1.60	240.0	90.1
3	Gray paint dipped	1.78	267.0	100.6

Radiator No. 2 was radiator No. 1, with the addition of one coat of aluminum bronze applied to the exposed surfaces. This radiator was painted as the ordinary radiator would be in the average installation. No attempts were made to cover the entire surface of the radiator with bronze, as this is not usually the case where radiators are painted by hand with a brush. The radiation factors given have been calculated for a temperature difference of 150° F.

HOW TEST FIGURES VARY FROM THOSE OF PREVIOUS TESTS

If bare iron be taken as the basic standard, it will be seen that the gray paint finish showed an increase of 0.6% in the amount of transmitted heat. The aluminum bronze caused a reduction of 9.9% in the amount of heat given out. These relative transmission values are different from those of the late Professor John R. Allen, which are widely published. Professor Allen's figures as commonly given are expressed as percentages in Table II.

TABLE II

Finish	Relative Transmission, Per cent
White enamel	101
Bare cast iron	100
White zinc paint	101
White lead paint	98
Gold bronze	76
Aluminum bronze	74

There is a large variation between the author's value and that of Professor Allen for the amount of the reduction of the heat transmission caused by aluminum bronze. This is a matter of much interest as the gold and aluminum bronzes have a widespread use because of their durability.

The writer believes that Professor Allen's figure of 26% for the heat transmission reduction is much too large to be applied to the average radiator installation. It is possible that the percentage of reduction of the heat transmitted may amount to somewhere near 18% with certain types of radiators, when covered with aluminum bronze, provided that they have practically all of their surface explored for radiation. A considerable portion of the surfaces of most radiators is not covered by any finish applied with a brush. This unfinished surface in a wide column radiator may amount to a large percentage of the total surface. The uncovered black or rusty surface is more effective in transmitting heat than that finished with bronze.

Professor V. S. Day has made tests at the University of Illinois, with a specially-designed plant, to determine the emissivity of heat from various surfaces.* This heat emissivity plant employs steam heated drums which are 10 in. in diameter and 20 in. long. The entire outside heat emitting surfaces of the drums can be finished and the air can move over the radiating surfaces freely by convection currents.

A test of the heat emissivity was made with one of these radiator drums badly rusted. This drum was then given one coat of aluminum bronze and the test repeated under the same conditions as those for the rusty drum trial. The aluminum bronze coating caused a reduction of 18.1% in the amount of transmitted heat. The entire surface of the drum was effective as a radiator with its surface entirely exposed, yet it gave a reduction 7.9% less than Professor Allen's minimum figure indicates that it should have given.

From these tests it is very evident that the application of aluminum bronze to the surfaces of radiators ordinarily used in direct steam heating will not cause a reduction of 26% or even 18% in the amount of heat transmitted by the surfaces. These percentages are too large. A reduction of 10% in the amount of transmitted heat is more nearly correct. This means that from 10% to 11% more square feet of direct radiation covered with aluminum bronze are necessary to supply a given heat loss, than would be necessary if clean radiators either fresh from the foundry, or dipped in gray paint were used without aluminum bronze.

* University of Illinois Engineering Experiment Station Bulletin No. 117 or 120.

Laboratory for Testing Small-Sized Anthracite

A laboratory has recently been established at the University of Pennsylvania, under the direction of Dr. Fernald, head of the Towne Scientific School of the university, where equipment for burning small-sized anthracite is being carefully tested and unbiased reports prepared for the benefit of the public generally. As a result of the tests conducted to date the laboratory has gone on record as recommending the magazine type of heater for burning buckwheat in new buildings. This heater, it is stated, provides for obtaining the requisite draft without mechanical aid by the maintenance of a relatively thin fuel bed which reduces the resistance to the flow of air through the fuel. The magazine feature, it is added, serves to maintain the thin fuel bed.

Winnipeg's New District Heating System

How the Necessity for a Standby Power Plant Furnished the Opportunity for Its Operation as a Heating Station—Possible Effect of Powdered Fuel Combustion on the Use of Canada's Vast Lignite Resources

ON November 15, 1924 was celebrated the official opening of a new district heating system in Winnipeg, Canada. This system, involving, as it does, several unique features, promises to mark a new era in district heating throughout the Dominion of Canada and the United States.

The events which led up to the decision of the City of Winnipeg to install a municipal district heating system are not only interesting but of sufficient importance to form a line of thought in the consideration of similar projects elsewhere.

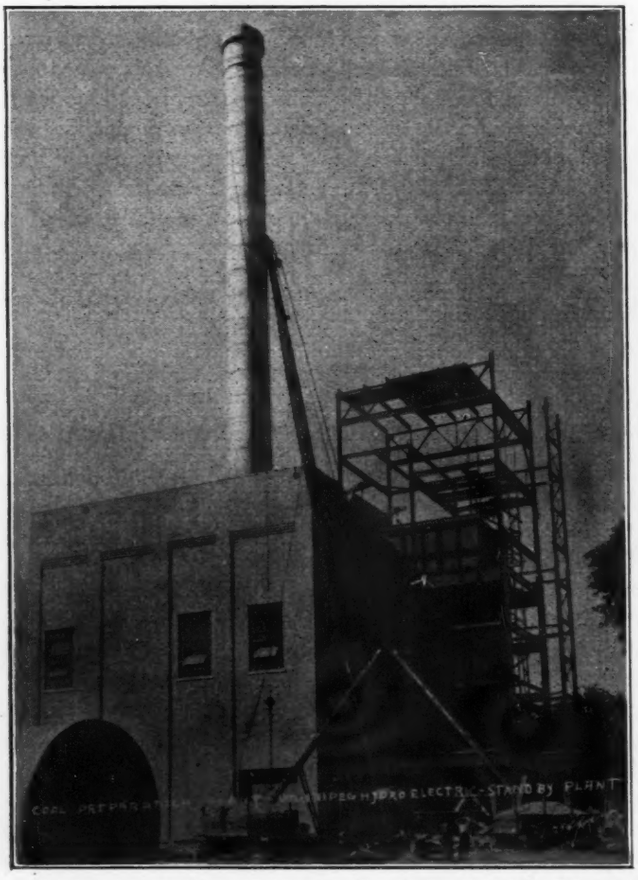
In the early part of the year 1922 the eastern portion of Manitoba was visited by two severe cyclones, from which the hydro-electric systems supplying light and power to Winnipeg suffered serious damage. On each occasion long sections of the transmission lines were destroyed and considerable losses and inconvenience were suffered by the people of Winnipeg during the complete interruption of all electrical supply. To meet the demand of its electrical power customers the City of Winnipeg quickly decided to build a steam standby power plant of sufficient capacity to serve light and power for the essential public utilities, and those power customers who might lose large quantities of perishable stock during an interruption to the hydro-electric service.

It was found that a steam power plant of at least 15,000 H.P. capacity would be required, involving an annual unproductive burden of approximately $100,000. A general survey of the economic situation of the municipal hydro-electric system, equipped with a large steam standby plant, brought to light two important facts:

1. The steam plant would not be required except for a few hours each year during the summer months, hence it would be available throughout the heating season for steam heating purposes.

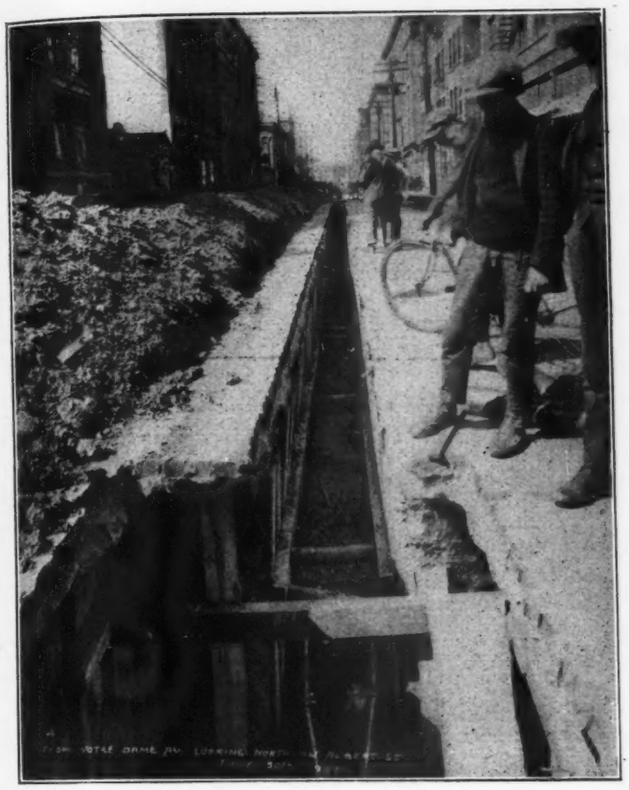
2. Large quantities of off-peak hydro-electric power were being wasted each year, which could be used for the production of steam during a considerable portion of the heating season.

It followed naturally that a district heating system, combined with the municipal hydro-electric system, would be very desirable, provided that steam could be economically distributed through the streets in the business section of the city and sold in competition with other forms of heating. Competent engineers were instructed to report on the feasibility of providing the City of Winnipeg with a district heating system, neglecting for the

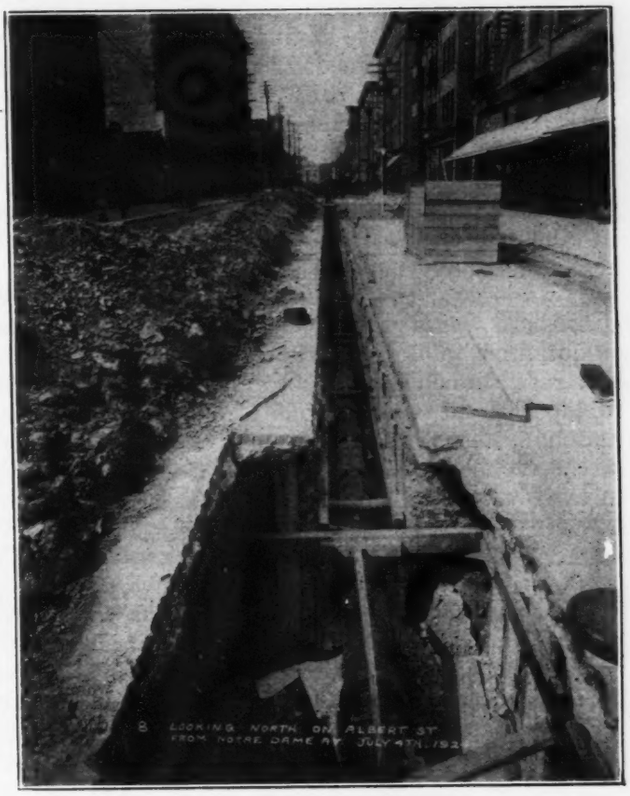


Coal Preparation Plant, Winnipeg Hydro-Electric Standby Plant

Operating Platform, Pulverized Fuel Boilers, Winnipeg Plant

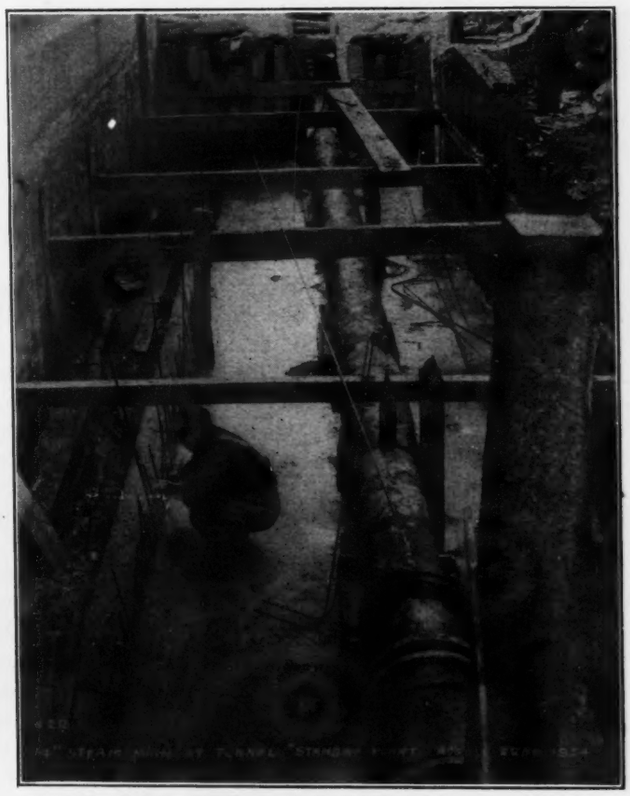


Looking North on Albert Street From Notre Dame Avenue, June 20, 1924



Looking North on Albert Street From Notre Dame Avenue Showing Arrangement of Insulation

View of Market Street East



14-In. Steam Main at Tunnel, Winnipeg Plant

Views of Pipe Conduit Work, Winnipeg Hydro-Electric Standby Plant

time being the possibility of its co-ordination with the hydro-electric system.

The report of these engineers pointed out the advantageous factors for district heating in Winnipeg, the long heating season, extremely low temperatures, high cost of fuel, good soil conditions and density of possible load. The report was so favorable that a by-law was successfully submitted to the public in November, 1923, for the expenditure of $900,000 on the first section of a steam distribution system and boiler plant.

It was felt at the time the project was submitted that there would be a certain amount of hesitation in obtaining public approval, due to district heating being to some extent a novelty in Canada. The highly efficient co-ordination of the district heating and hydro-electric utilities was therefore particularly emphasized, and the overwhelming majority in favor of the scheme is attributed to this feature.

HOW THE IDEA FOR A HEATING PLANT WAS WORKED OUT

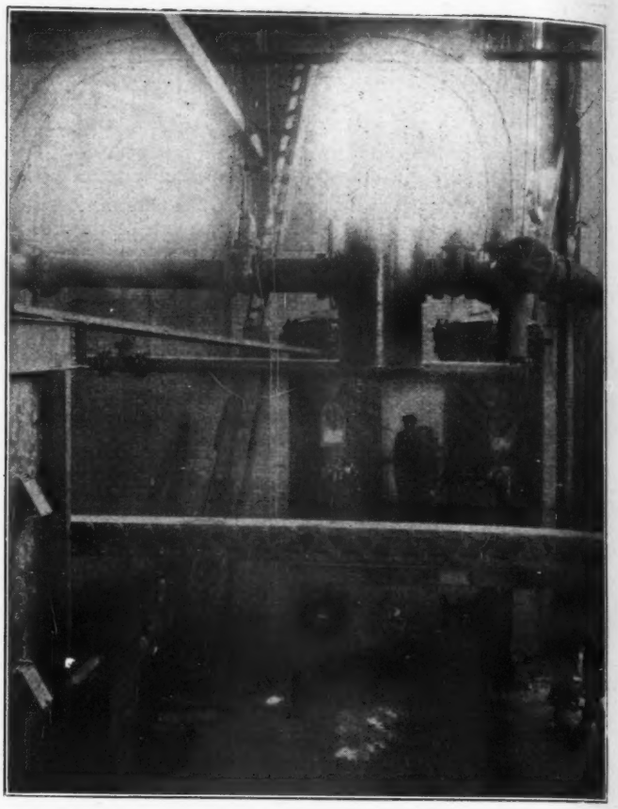
Briefly, the idea has been worked out as follows. The heating plant, which is also an electrical standby plant, has at present three 1100 H.P. boilers for burning pulverized fuel and two 7500 K.W. electric boilers. In order to have reserve boiler capacity for electrical standby service, the steam heating load will be contracted for only up to about half of the total capacity of the plant. In other words, while the boilers installed can be operated at 300% of rating, the heating load will only be accepted for a demand equivalent to about 150% of rating. The additional capacity will only be used at such times as it is necessary to generate current at the plant to augment the hydro-electric service. To compensate the heating plant for this standby service, all surplus hydro-electric power developed will be supplied to the electric boilers to generate steam for heating. The hydro plant will be operated at practically a constant load, the electric boilers in the heating plant utilizing all current generated over and above the demand on the transmission lines.

This combination of heating plant and electrical standby plant also proves economical for the Winnipeg water system. The water is obtained by aqueduct from a lake about 80 miles from Winnipeg. Heretofore it has been necessary to maintain a steam standby plant for water service, but now, since continuous electrical service is assured by the electrical standby plant, the waterworks standby has been motorized with a resultant reduction in operating costs.

The steam boilers installed have been designed with the object of obtaining extremely high efficiencies. The latest system of powdered fuel combustion is being used, making it possible to burn successfully any class of fuel, from high-grade American coals to the low-grade lignite coals of the Canadian West.

POSSIBILITIES IN THE UTILIZATION OF CANADA'S VAST LIGNITE RESOURCES

It is expected that the Winnipeg plant may be the beginning of a new era in the use of the vast lignite resources that lay just beyond the western boundary of Manitoba. Although Western lignite coal, used in powdered form, can now be used advantageously in preference to the American coal, the difference in cost is yet too small to provide the Canadian coal producer with sufficient encouragement and profit to develop an enterprising expansion of his business.



Electric Boilers Under Construction, Winnipeg Plant

EQUIPMENT OF WINNIPEG PLANT

Following is a tabulated description of the Winnipeg plant equipment:

Three vertical water-tube boilers, 1100 h.p. each, 240 lbs. pressure.....by Jno. Inglis, Toronto
Furnace arches.....H. Detrick Co.
Furnace design and special tiles.....Combustion Engineering Co.
Feed-water heater, Cochrane type....Allis Chalmers Co.
Feed pumps, one motor-driven, one turbine-driven, 360 g.p.m. at 625 ft. head
Superheaters, Foster type.....Power Specialty Co.
Booster pumps, Pulsometers.....Mussens, Ltd.
Flow meters, Republic type.....Dominion Flow Meter Co.
Two Electric steam generators, each 7500 kw. capacity at 4400 volts, three phase...Canadian General Electric Co.
Two 5000 kw. steam turbines, Zoelly type..Howden & Co., Glasgow
One 1000 kw. steam turbine (house unit)
Alternators.....Parsons Co., Newcastle-on-Tyne
Condensers, surface type, with Hick-Brequet ejectors, capacity 6200 lbs. per hour..Hick Hargraves, Bolton, Eng.
Four circulating pumps.....Mather & Platt, Manchester
Lubricating pumps, reciprocating...Worthington, England
Overhead crane, 25 tons.....Hepburn & Sons, Toronto
Coal handling and pulverizing—General contract by....Combustion Engineering Co.
One skip hoist, 50 tons per hour.
One crusher, 50 tons per hour.
One magnetic separator, 50 tons per hour.

(*Continued on Page 62*)

This is the fourth lesson of

The Heating and Ventilating Magazine's

New Home-Study Course in Gravity Steam and Water Heating

Instruction in this course is available only to subscribers of THE HEATING AND VENTILATING MAGAZINE. The first lesson appeared in November, but **you can commence the course any time.** As soon as your enrollment is received, Lesson 1 will be sent to you, together with the Work Problems pertaining to Lesson 1. Full directions will be included as to where to send your solutions of the Work Problems.

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The cost of the course complete, consisting of not less than 30 lessons, including a critical analysis of the work problems as solved by each student, is $80.00, payable in equal monthly installments of $10.00 each.

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IMPORTANT—Students who satisfactorily complete the course will be awarded a Graduation Certificate which will correspond in value to the character of the lessons themselves.

Lesson No. 4. Heat Loss Computations—Rule-of-Thumb Methods

THERE are a number of methods or rules used as short cuts for estimating the heat loss by which to proportion the heating surface when direct radiation is to be used. They are often spoken of as "rule-of-thumb" methods. Such rules are intended to be based on averge building construction and a ratio of wall and glass surface to the cubical contents of the structure as found in the class of building to which they might be applied.

These rules, when modified for unusual conditions and applied by an engineer with long experience in the proportioning, design and installation of heating systems, may produce satisfactory results. They are passing out of use by the more advanced contractors who use them only for rough approximate estimating or as a quick check for the more refined B.T.U. method covered in Lesson 3.

Rule-of-thumb methods of estimating heat loss should never be used as the basis of calculation for the design of a heating system because all factors that may directly influence the heat loss for different types of walls, different exposure conditions and infiltration losses are not properly considered.

It is advisable, however, that every student of heating and ventilating engineering be informed concerning the application of a few rule-of-thumb methods and to understand how the results obtained from their use for a given structure compare with those obtained by using the B.T.U. method.

Three rule-of-thumb methods will be considered; namely, E.G.S. Method (Equivalent Glass Surface

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(Do not fill in.) *Application for Enrollment for*

TECHNICAL INSTRUCTION
(BY MAIL)
IN GRAVITY STEAM AND WATER HEATING

HEATING AND VENTILATING MAGAZINE CO.,
1123 Broadway,
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GENTLEMEN:

I enclose $10.00 for which please enroll me as a student in the home-study course in steam and water heating which you have arranged for your subscribers to take from the A-Em-Dee Engineering Co., Heating and Ventilating Engineers, subject to the following conditions:

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(2) If this application is accepted, I agree to pay the remaining balance, after deducting this first payment, in regular monthly installments amounting to not less than $10.00 monthly (commencing five days from the date of notification of the acceptance of this application) until the full amount has been paid.

(3) In consideration of the payments above specified, it is understood that I am to be supplied with text assignments as published monthly in THE HEATING AND VENTILATING MAGAZINE; work problems, additional tables and all matter that constitutes the course, by mail direct from the A-Em-Dee Engineering Company.

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(6) I agree on my part to prosecute the work energetically, to devote regular time to study (in so far as may be possible) and to complete it without delay unless interference is caused by sickness or other unavoidable causes.

Name.....

Address.....

Date..... Accepted.....

Method); Carpenter's Rule; and Allen's Rule.

EQUIVALENT GLASS SURFACE METHOD (E.G.S. METHOD)

This method is based on the amount of heat transmitted through 1 sq. ft. of glass surface per hour when the inside temperature is 70° F, and the outside is 0° F., or for a temperature difference of 70°. Experiments have shown that 1.2 B.T.U. is a safe heat unit value to use for the heat transmission through 1 sq. ft. of single thickness of glass surface per hour, per degree difference between the inside and outside temperatures, or 70 x 1.2 B.T.U. = 84 B.T.U. for 70° difference between the inside and outside temperatures.

The quantity of heat transmitted through the wall per square foot of surface per hour, for a temperature difference of 70° F., is then assumed to bear a direct relation to the heat transmitted by the glass surface under similar conditions, and from this relation, the number of square feet of wall surface that will transmit the same number of B.T.U. as 1 sq. ft. of glass surface in the same time is established.

This relation will vary for different types of walls, but in applying this rule for ordinary residence construction the walls may generally be considered as limited to the types indicated in Table 20. The relation that exists between the heat transmitted by the glass surface and the wall surface is given for each type of wall. Thus, for example, every 2 sq. ft. area of the wall,—stucco on framing, and plaster finish (last item), will transmit the same amount of heat as 1 sq. ft. of glass surface. One sq. ft. of glass surface will transmit 84 B.T.U. per hour for 70° temperature difference; therefore 1 sq. ft. of wall surface of this type will transmit ½ of 84 B.T.U. or 42 B.T.U. under the same conditions of temperature inside and outside.

By special arrangement with the A-Em-Dee Engineering Company, students in The Heating and Ventilating Magazine's Home-Study Course in Gravity Steam and Water Heating will be supplied with the lessons complete in convenient loose-leaf form. They will be printed on a fine grade of bond paper 6 in. by 9 in., triple punched, suitable for permanent filing in ring binders.

Each lesson will be accompanied by a cover sheet of different color and a set of the work problems. Each set of work problems will be issued on a different color paper so that they will be readily distinguishable from one another and each lesson will contain in detail a complete index by pages of the various subjects covered, together with an index of figures and tables.

All submitted work will be received on paper cut to the same size as the lessons so that when a student has completed the course he will possess a complete reference work on the subject, thoroughly indexed, which will prove invaluable to him in his future work.

TABLE 20. EQUIVALENT WALL SURFACE

(Number of square feet of wall, of type indicated that will transmit same number of B.T.U. per hour as 1 sq. ft. of glass surface under the same conditions).

Type of Wall	Equivalent Area
Brick, 12 in. thick, plaster inside.....	4
Clapboards, sheathing paper, plaster finish.	3
Clapboards, paper, wood sheathing, plaster finish	4
Hollow tile, 8 in., stucco and plaster finish.	3
Stucco on framing and plaster finish.....	2

Cubical Contents Factor

Assume 60 cu. ft. of room volume equivalent to 1 sq. ft. of glass surface per air change per hour.

APPLICATION OF THE E.G.S. METHOD

The steps required in the application of this method are enumerated below. (The student should submit work involving this method in this form on sheets supplied for the purpose). Each wall should be considered separately, as north wall, west wall, etc.

First: Determine the number of square feet of exposed glass and door surface in the wall under consideration, multiply by the value 84, and obtain the B.T.U. loss through the glass.

Second: Select a factor from Table 20 corresponding to the type of wall under consideration and divide 84 by this factor.

Third: Determine the net area of exposed wall surface, multiply by result SECOND and obtain the B.T.U. loss through the wall.

Fourth: Apply exposure factors from Table 13, Lesson 2, to results of FIRST and THIRD, when necessary. If no exposure allowance is included, use FIRST and THIRD as calculated above. Thus the total B.T.U. loss from one wall, including exposure is obtained.

Fifth: Consider each of the other exposed walls of the room and proceed as noted under FIRST, SECOND, THIRD and FOURTH.

Sixth: After the B.T.U. loss from each wall has been calculated as noted under FIFTH add the loss for all the walls.

Seventh: Calculate the cubical contents of the room and multiply this by 1.40. This gives the B.T.U. required for one air change. For 1½ air changes, multiply by 1.87. For two air changes multiply by 2.8.

TABLE 21—COMPOSITION OF PURE AND RESPIRED AIR

CONSTITUENT	PURE AIR	RESPIRED AIR
OXYGEN	20.26%	16.2%
NITROGEN	78.00%	75.0%
CARBON DIOXIDE	0.04%	4.0%
WATER VAPOR	1.50% VARIABLE	5.0%

R.C. CARPENTER

Eighth: If there is an unheated attic over the room (generally known as cold ceiling) assume that 8 sq. ft. of ceiling will transmit the same number of B.T.U. as 1 sq. ft. of glass. Divide 84 by 8 = 10.5 and multiply the result by the area of the ceiling.

Ninth: Add B.T.U. values obtained under SIXTH, SEVENTH and EIGHTH and obtain total B.T.U. loss for room under consideration.

Work Problems Nos. 52 and 53

CARPENTER'S RULE

The following rule which takes its name from that of its author has been widely used in this country. As presented, it is not intended to be applied to buildings covered with corrugated sheet steel or metal lath or plaster walls.

The steps required in the application of this rule are enumerated below. (The student should follow this form in submitting work by this rule on sheet supplied for the purpose).

First: Calculate the volume of the room in cubic feet.

Second: Multiply the result of FIRST by the number of air changes per hour.

Third: Divide the result of SECOND by 55.

Fourth: Calculate the area in square feet of the exposed side (or sides) of the room.

Fifth: Calculate the area in square feet of the windows and door openings in the wall, the area of which was found under FOURTH.

Sixth: Deduct result FIFTH from result FOURTH and get the net exposed wall surface.

Seventh: Divide the result SIXTH by 4.

Eighth: Add the results found under THIRD, FIFTH and SEVENTH.

Ninth: Multiply result EIGHTH by the difference between the inside and outside temperature and obtain the heat loss in B.T.U. for the given conditions.

Work Problem No. 54

ALLEN'S RULE

The following rule which also takes its name from that of its author may be applied in the following steps. (The student should follow this form and submit results on sheet supplied).

TABLE 22.—VOLUME OF AIR REQUIRED FOR VARIOUS STANDARDS OF PURITY

STANDARD OF PURITY	CUBIC FEET OF AIR (4 TO 10000) TO BE SUPPLIED PER PERSON	
PARTS OF CO_2 ALLOWED PER 10000 IN ROOM AIR	PER MINUTE	PER HOUR
5.0	100.0	6000
5.5	66.6	4000
6.0	50.0	3000
6.5	40.0	2400
7.0	33.3	2000
7.33	30.0	1800
7.5	28.6	1714
8.0	25.0	1500
9.0	20.0	1200
10.0	16.6	1000
15.0	9.1	545
20.0	6.2	375
30.0	3.8	231

HARDING & WILLARD

TABLE 23—VOLUME OF AIR REQUIRED FOR GIVEN STANDARD OF PURITY

CUBIC FEET OF SPACE IN ROOM PER INDIVIDUAL	PROPORTION OF CARBONIC ACID IN 10000 PARTS OF AIR NOT TO BE EXCEEDED AT END OF AN HOUR						
	6	7	8	9	10	15	20
	CUBIC FEET OF AIR (4 TO 10000) TO BE SUPPLIED PER HOUR						
100	2900	1900	1400	1100	900	445	275
200	2800	1800	1300	1000	800	345	175
300	2700	1700	1200	900	700	245	75
400	2600	1600	1100	800	600	145	NONE
500	2500	1500	1000	700	500	45	
600	2400	1400	900	600	400	NONE	
700	2300	1300	800	500	300		
800	2200	1200	700	400	200		
900	2100	1100	600	300	100		
1000	2000	1000	500	200	NONE		
1500	1500	500	NONE	NONE			
2000	1000	NONE					
2500	500						

HARDING & WILLARD

TABLE 24—NUMBER OF AIR CHANGES PER HOUR

USE OF ROOM	CHANGES OF AIR PER HOUR
PUBLIC WAITING ROOMS	8 TO 12
PUBLIC TOILETS	10 TO 20
COAT AND LOCKER ROOMS	8 TO 12
MUSEUMS	4 TO 5
OFFICES, PUBLIC	8 TO 12
OFFICES, PRIVATE	4 TO 5
DINING ROOMS, PUBLIC	8 TO 12
LIVING ROOMS	4 TO 5
LIBRARIES, PUBLIC	4 TO 6
LIBRARIES, PRIVATE	3 TO 4

TABLE 25—AIR CHANGES DUE TO NATURAL INFILTRATION WITH DIRECT HEATING SYSTEMS

TYPE OF BUILDING	NUMBER CHANGES PER HOUR
RESIDENCE	HALL 3 - SITTING ROOM, ETC. 2 - SLEEPING ROOM 1
STORE	FIRST FLOOR 2 TO 3 - SECOND FLOOR 1½ TO 2
OFFICE	FIRST FLOOR 2 TO 2½ - SECOND FLOOR 1½ TO 2
CHURCH & ASSEMBLY HALL	FROM ¾ TO 3
LARGE ROOM, SMALL EXPOSURE	FROM ½ TO 1

R.C. CARPENTER.

TABLE 26—AIR REQUIRED FOR VENTILATION

TYPE OF BUILDING	CUBIC FEET OF AIR REQUIRED PER PERSON	
	PER MINUTE	PER HOUR
HOSPITALS, ORDINARY	42	2500
HOSPITALS, SURGICAL CASES	50	3000
HOSPITALS, CONTAGIOUS DISEASES	100	6000
SCHOOLS, ADULTS	40	2400
SCHOOLS, CHILDREN	30	1800
THEATRES	40	2400
CHURCHES	30	1800
PRISONS	30	1800
ASSEMBLY HALLS	30	1800
FACTORIES	33	2000
FACTORIES (UNHEALTHY TRADES)	59	3500

First: Calculate the area in square feet of the window and door openings in the exposed wall.

Second: Calculate the area of the exposed wall in square feet.

Third: Subtract result FIRST from result SECOND and get the net area of exposed wall in square feet.

Fourth: Divide the result THIRD by 4.

Fifth: Add the result of FOURTH to result FIRST.

Sixth: Multiply the result FIFTH by the difference between the inside and outside temperature.

Seventh: Multiply result SIXTH by the number of air changes per hour and obtain the heat loss in B.T.U. for given conditions.

Work Problems Nos. 55, 56 and 57

EFFECT OF VENTILATION UPON B.T.U. LOSSES

In calculating heat losses by the different methods discussed the heat required for heating the air supplied for ventilating purposes has not been considered. This may be an important item especially with mechanical ventilating systems.

It is not intended in this part of the course to enter into a discussion of the principles of air conditioning but merely to explain briefly in a general way, how the B.T.U. loss as calculated for transmission and infiltration may be insufficient when it is necessary to introduce additional air in order that a required degree of purity be maintained.

Ventilation, whether NATURAL OR MECHANICAL embodies the displacement of vitiated air from a space and its replacement with fresh air. It should not be considered that the air in a space is completely renewed any given number of times per hour as this is not strictly accurate, since a positive change does not actually occur. What does happen is that the incoming air mixes with and dilutes the foul air to a point suitable for healthful respiration.

DESIGN DATA HOT WATER OR STEAM HEATING DE

.....FLOOR DATA AND CALCULATIONS FOR .....

REFERENCE	SURFACE OR DESCRIPTION	TRANSMISSION FACTOR B.T.U. PER HR. PER 1 SQ. FT.		ROOM DESIGNATION															
				VOL. ..... CU. FT.				VOL. ..... CU. FT.				VOL. ..... CU. FT.				VOL. ..... CU. FT.			
		PER 1°	PER °	SQ. FT.	H WITHOUT EXPOSURE	EXPOSURE FACT.	H WITH EXPOSURE	SQ. FT.	H WITHOUT EXPOSURE	EXPOSURE FACT.	H WITH EXPOSURE	SQ. FT.	H WITHOUT EXPOSURE	EXPOSURE FACT.	H WITH EXPOSURE	SQ. FT.	H WITHOUT EXPOSURE	EXPOSURE FACT.	H WITH EXPOSURE
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	WALL																		
B	GLASS																		
C	INFILTRATION																		
D	FLOOR																		
E	CEILING																		
F	TOTAL H	——		—		—		—		—		—		—		—		—	
G	KIND OF RADIATORS (DIRECT) (INDIRECT) (DIRECT-INDIRECT)																		
H	TYPE OF RADIATOR																		
I	COEFFICIENT OF HEAT TRANSMISSION (TABLE 79)																		
J	B.T.U. PER SQ. FT. PER HOUR																		
K	DIRECT RADIATION - SQ. FT. REQUIRED																		
L	ACTUAL RADIATING SURFACE - INSTALLED																		
M																			

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Sample Form of Systematized Calculation Sheet for Submitting Work Problem Solutions by the B.T.U. Method of Calculating Heat Loss

Similar Forms are Supplied Students for Submitting Results by the Other Methods Covered in This Lesson

To be well ventilated, a room should contain, at all times, air of such volume and purity as will assure the removal of the proper quantity of heat from the human body when clothed normally. The air must have proper characteristics as governed by its temperature, humidity and motion. It must contain oxygen in required quantity to support human life properly, be free from harmful bacteria and low in dust count. It should be free of bodily and other objectional odors and harmful gases. It must be supplied to all parts of the enclosed space in sufficient quantity to provide amply for the required conditions.

Carbonic Acid as an Index to Comparative Air Purity

While outside air may be considered as pure, it will not long stay so when inhaled and expired. The composition of pure (comparative) air and respired air is shown in Table 21.

When the air is taken into the lungs, its temperature is that of the room but when expired it has a temperature of from 90° to 98° F. It is also nearly saturated with water vapor and is from 1% to 3% lighter. These changes, however, are not the greatest. Notice that the per cent of carbonic acid has increased about 100 times, or from 4 parts to 400 parts in 10,000 parts.

Work Problem No. 58

As air is exhaled, the gases immediately begin to diffuse and the carbonic acid is soon distributed quite uniformly throughout the air of the room, thereby increasing the content above 4 parts in 10,000. This diffusion continues with an increase in the per cent of carbonic acid gas up to about 7 parts in 10,000 when the effect of poor ventilation is easily apparent. When 10 parts is reached actual discomfort may occur. Therefore it is customary to control this increase in carbonic acid gas content by ventilation; that is, by supplying the number of cubic feet of outside air for each person, necessary to maintain some desirable standard of purity.

An adult at rest requires about 20 cu. in. of air at each respiration and makes from 16 to 24 respirations per minute, so that a total of 320 to 480 cu. in. of air per minute are required for an adult. This is approximately 0.25 cu. ft. For adults exercising, this amount may be increased to 0.33 cu. ft.

This exhaled air contains 4 parts of carbonic acid gas in 100 parts or 400 parts in 10,000 parts. This is 4% or 4 one-hundredths. Therefore an adult at rest gives off 0.25 (cu. ft.) x 60 (minutes) x 0.04 (proportion) = 0.6 cu. ft. of carbonic acid gas per hour.

On this basis 0.60 cu. ft. of carbonic acid gas is produced per hour by an adult at rest. If we assume the proportion of 4 parts in 10,000 in the outside air, and that we may allow 7 parts in 10,000 as safe in an occupied room, then the gain in carbonic acid content after admission to the room will be 3 parts in 10,000. This means that if we divide 3 by 10,000 we will get the cubic feet of carbonic acid that may be mixed with each cubic foot of fresh air that enters the room before it exceeds the proportion of 7 parts in 10,000. Thus 3 ÷ 10,000 = 0.0003 cu. ft.

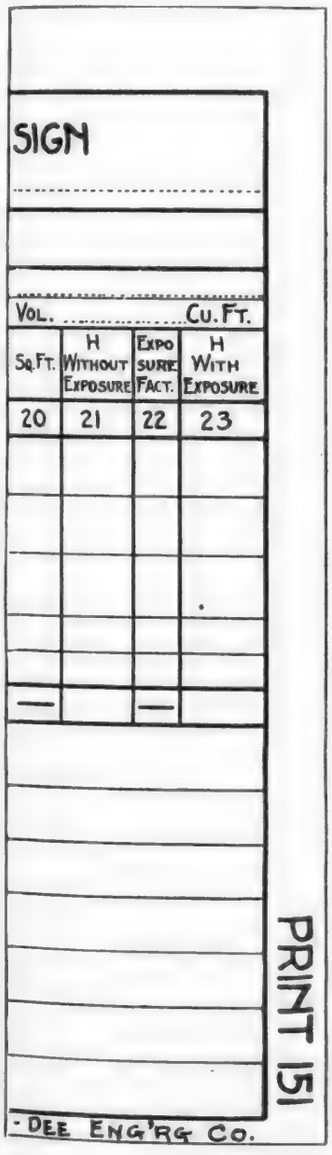
In order to keep the air in a room at the standard of purity assumed:—7 parts in 10,000 parts,—it will be necessary to supply 0.60 ÷ 0.0003 = 2000 cu. ft. of air per hour per person.

Work Problem No. 59

In order to facilitate such calculations, Table 22 is presented. By this table, the number of cubic feet of air required per person per minute or per hour may be obtained directly for various standards of purity. For instance, if there was permitted a proportion of 7.5 parts of carbon dioxide to 10,000 parts of air, 28.6 cu. ft. of air per minute per person or 1714 cu. ft. per hour would be required.

Work Problem No. 60

When the problem is presented in a somewhat



different manner, Table 23 will be found useful. For instance, suppose the size of a room which is to be used as an assembly hall for a given number of people is known and it is desired to know how many cubic feet of air must be supplied per hour in order to maintain a desired purity.

Assume the volume of the room as 57,600 cu. ft. and that 200 people will occupy it. Dividing 57,600 by 200 the quotient is 282 cu. ft. per person. Calling this 300 and allowing 7 to 10,000 parts it is indicated by Table 23, that 1700 cu. ft. of air must be supplied per hour.

Work Problem No. 61

AIR REQUIRED FOR VENTILATION

Whenever possible, the air supply to any given room should be based upon the number of occupants. Unfortunately these data are not always available. Therefore the amount of air to be supplied per hour is often based upon the number of air changes considered good practice. Table No. 24 will serve as a guide in this connection. The quantity of air required per person for various classes of service in good ventilation practice is given in Table 25, the data having been compiled from several sources. Unless otherwise stated the data in this table is to be used in problems where such data are needed.

HEAT LOSS BY VENTILATION

One B.T.U. will raise the temperature of 1 cu. ft. of air 55° at average temperatures and pressures;—or it will raise 55 cu. ft. through 1 degree. Therefore, if the number of cubic feet of air per hour required for ventilating purposes and the number of degrees through which it is to be warmed are known, to find the total required B.T.U. it is only necessary to multiply the quantity of air by the temperature rise and divide by 55. For instance suppose it is desired to determine the number of B.T.U. required per hour in zero weather for the ventilation of a church seating 400 people, inside temperature 70° F.

Total air required = 1800 (Table 26) × 400 = 720,000 cu. ft.

$$\text{B.T.U.} = \frac{720{,}000 \times 70}{55} = 916{,}000 \text{ B.T.U.}$$

Note that the rise in temperature and the 55 are constant so values may be established for the ratio $\frac{\text{Temp. rise}}{55}$. The following represent values most commonly used.

Thus:—

For 60° rise, 60 ÷ 55 = 1.09
For 65° rise, 65 ÷ 55 = 1.18
For 68° rise, 68 ÷ 55 = 1.24
For 70° rise, 70 ÷ 55 = 1.27
For 72° rise, 72 ÷ 55 = 1.31
For 80° rise, 80 ÷ 55 = 1.46

Work Problem No. 62

Lesson No. 5, to appear next month, will cover the effect of ceiling height on average mean temperature, effect of auxiliary sources of heat supply, approximate estimate of heating plant size and fuel requirements, and equivalent temperature guarantees.

Winnipeg's New District Heating System

(*Continued from page 55*)

Two pulverizers, Raymond, 6 tons per hour each.
Two dryers, (Green), waste heat, 210 sq. ft. drying surface.
Three sets, group feeders, Lopulco.
Three water screens, (Lopulco) 326 sq. ft. heating surface.
Three coal conveyors, each 30 tons per hour.

STEAM DISTRIBUTION SYSTEM

The steam distribution system was designed by Norman W. Calvert, of Detroit, Mich., and is quite similar in design to that used in Detroit. Because of the high tariff on American-made goods, it was found advantageous to cast fittings, line wedges, pipe supports, and similar devices in Winnipeg foundries.

The concrete conduit was constructed with a double line of drain tile, inasmuch as the alkaline condition of the sub-soil moisture is very harmful to concrete and perfect drainage is essential to prevent the alkaline water from remaining in contact with the concrete.

All mains and services are insulated with 1½ in. Johns-Manville asbestos sponge felted covering and waterproofed with a layer of waterproofing felt.

14,000 FEET OF MAINS INSTALLED

The construction program during 1924 covered the installation of approximately 14,000 feet of main, varying in size from 14 in. to 6 in. There were also 4000 feet of service pipes from 2½ to 6 in. in size. The main line pressure will be so controlled and regulated that each customer will have available at his service valve, a pressure of at least 10 lbs. per square inch, and this will again be reduced, in the customer's premises, to the pressure actually required for his particular heating system. Long-distance recording instruments will be installed to enable the engineers at the boiler plant to read at any time the pressure and temperature of the steam at any important location on the system.

The system was put in operation early in October and is now serving 110 customers, with a total connected radiation of 350,000 square feet.

Developments on this system will be watched With a great deal of interest by heating and hydro-electric men throughout the world as it may furnish the answers to many problems heretofore difficult of solution.

Effective Temperature With Clothing

Equivalent Conditions of Temperature, Humidity and Air Movement, Determined by Individuals Normally Clothed

By C. P. Yagloglou and W. Edw. Miller

From a paper presented at the annual meeting of the American Society of Heating and Ventilating Engineers, in Boston, January 28–30, 1925

All of the previous experiments on the subject of "effective temperatures" were made on men stripped to the waist. In the present experiments, the individuals were normally clothed and slightly active. The results of the investigation are summed up and made available for practical use in the accompanying chart (Fig. 1) which is undoubtedly the most outstanding achievement of the A. S. H. & V. E. Research Laboratory in the field of air-conditioning.

IN PRINCIPLE, the same procedure was followed as in the previous experiments to determine what conditions were equivalent. Briefly, the method consisted in finding a condition of comparatively high dry-bulb temperature and low humidity in one chamber, which gave the same feeling of warmth as a saturated condition with lower temperature in the other chamber. In the experiments with air movement, the humidity in the two chambers was kept the same, but the dry-bulb temperature in the velocity chamber was, as a general rule, higher than that in the still-air chamber thus counterbalancing the cooling effect of wind.

In the very high temperatures the clothing was exposed to the hot air for some time before putting it on. Changes in the room conditions were gradual, and the field covered in a single day with full range of humidity did not exceed 20° F. in dry-bulb temperature.

The temperature range covered in the present work was from 33° to 165° dry-bulb and from 26° to 115° wet-bulb.

It was observed that a saturated condition of 65° is equivalent to one of 71.7° dry-bulb with 20% relative humidity when clothing is worn, and to another of the same humidity as the latter but of 75° dry-bulb temperature, when stripped to the waist. In other words, for the same effective temperature value of 65° and with 20% relative humidity, the dry-bulb temperature in the former case (with normal clothing) is 3.3° lower than in the latter.

A comparison of the chart here presented (Fig. 1) with the one presented in the A.S.H.&V.E. *Journal* for March, 1923, for individuals stripped to the waist, will show clearly the effect of clothing. It will be observed that clothing increases considerably the slope of the effective-temperature lines below 94° effective temperature and decreases their slope above this temperature. In other words, for ordinary temperatures dry-bulb becomes a much more important factor in the comfort of a clothed person than wet-bulb temperature, a fact that justifies to a certain extent the original belief in dry-bulb temperature as being the sensible temperature.

Although at 65° effective temperature it was found previously that for subjects stripped to the waist 1° of dry-bulb temperature is equivalent to 0.9° of wet-bulb, it is significant to note that for subjects normally clothed, 1° of dry-bulb is equivalent to 2° wet bulb. Therefore, under ordinary conditions of temperature and clothing, an increase of 1° in the dry bulb temperature of the air should be accompanied by a decrease of 2° in wet bulb, in order that the warmth of the condition may remain unchanged.

It is of interest to note in this connection that the clothed body simulates a dry-bulb thermometer at a temperature of 46°, while this was found to take place with subjects stripped to the waist at 32°. Below this temperature the higher the humidity the cooler the condition. This fact brings us nearer to common experience in observing the difference between dry and damp weather at temperatures considerably above freezing. As a matter of fact, there is always outdoors a certain amount of air movement, and it will be seen later that the greater the air velocity the higher the temperature at which the clothed body assumes the thermal properties of a dry-bulb thermometer.

(Data and curves were presented in the paper showing effective temperatures with normal clothing under still-air conditions and with air-velocities of 300 ft. per minute. Corresponding data, it was stated, have been obtained for other air velocities).

Based on the tests, one of the important conclusions reached was that as the velocity increases, dry-bulb temperature becomes more important than wet-bulb temperature.

THE "HUMAN THERMOMETRIC" CHART

Efforts to devise a single practical chart that will include all the facts pertaining to the laws governing the thermal properties of the human body, and by means of which the effective temperature of any condition within the experimental range could be easily determined, resulted in the development of the "human thermometric chart" shown in Fig. 1.

The chart is principally composed of two vertical and uniform scales; the dry-bulb temperature scale on the left and the wet-bulb scale on the right; these are the two values actually measured in practice. The long curved lines extending diagonally across the chart are lines of equal air velocity spaced in intervals of 100 ft. per minute, as shown by the scale on the left edge of the diagram. The effective-temperature lines are represented by the short cross lines, and join together all equivalent

conditions of dry-bulb temperature, wet-bulb, and velocity of air.

Fig. 1 affords a complete formulation of the laws of cooling of the human body. The proximity of any point to the dry and wet-bulb temperature axes indicates the superiority of one temperature over the other in determining human comfort. For ordinary temperatures the points are nearer to the dry-bulb temperature axis, while for high temperatures, when sensible evaporation comes into play, the upper part of the diagram approaches the wet-bulb axis. A vertical line drawn half-way between the two temperature scales will intersect the various velocity curves, at points where dry- and wet-bulb temperatures are of equal importance. For instance, with still air this occurs at an effective temperature of about 77° while with a velocity of 500 ft. per minute it occurs at a saturated temperature of 86.0°, or at an effective temperature of 80.7°.

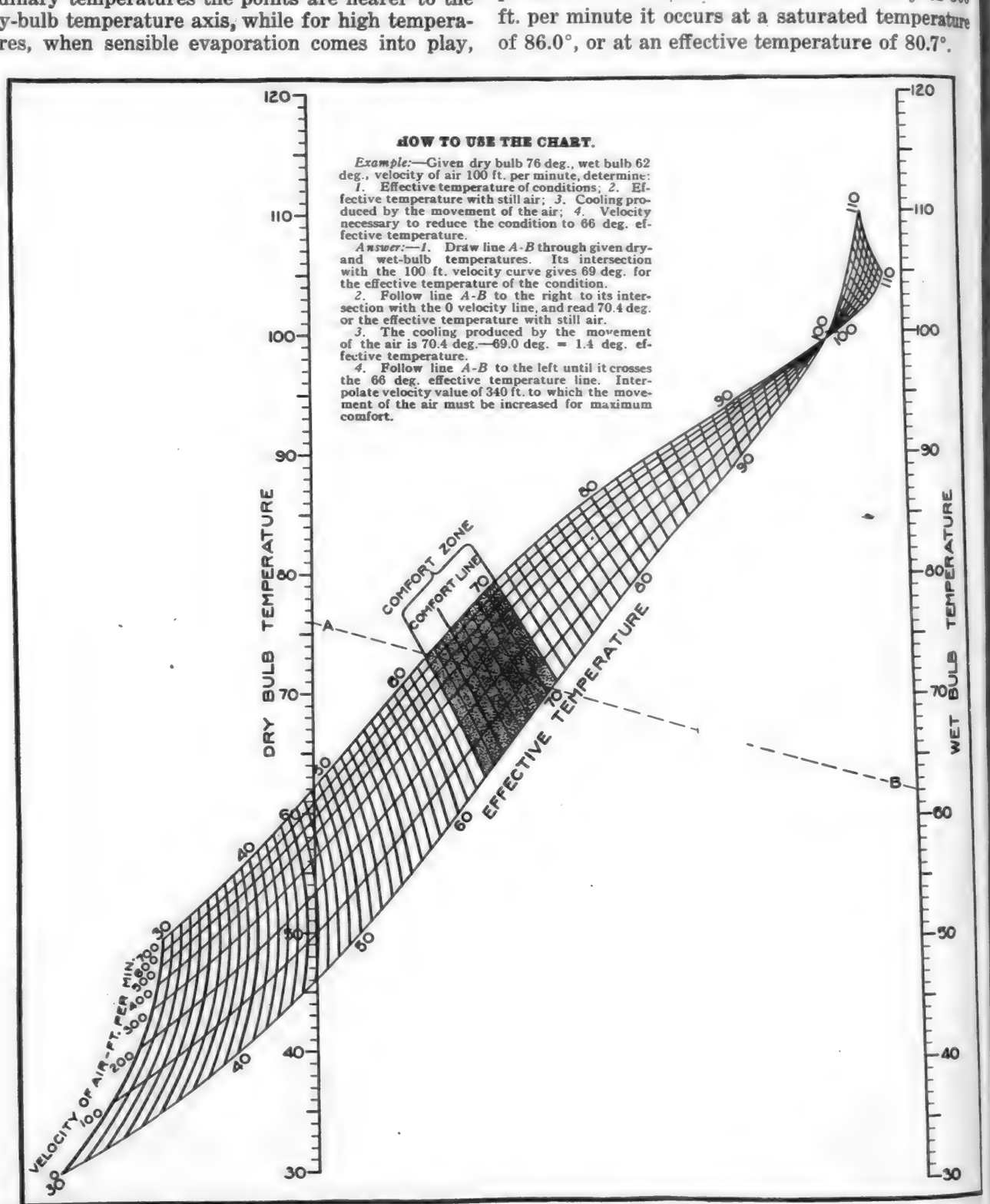

HOW TO USE THE CHART.
Example:—Given dry bulb 76 deg., wet bulb 62 deg., velocity of air 100 ft. per minute, determine: 1. Effective temperature of conditions; 2. Effective temperature with still air; 3. Cooling produced by the movement of the air; 4. Velocity necessary to reduce the condition to 66 deg. effective temperature.
Answer:—1. Draw line A-B through given dry- and wet-bulb temperatures. Its intersection with the 100 ft. velocity curve gives 69 deg. for the effective temperature of the condition.
2. Follow line A-B to the right to its intersection with the 0 velocity line, and read 70.4 deg. or the effective temperature with still air.
3. The cooling produced by the movement of the air is 70.4 deg.—69.0 deg. = 1.4 deg. effective temperature.
4. Follow line A-B to the left until it crosses the 66 deg. effective temperature line. Interpolate velocity value of 340 ft. to which the movement of the air must be increased for maximum comfort.
DRY BULB TEMPERATURE
WET BULB TEMPERATURE
EFFECTIVE TEMPERATURE
COMFORT ZONE
COMFORT LINE
VELOCITY OF AIR-FT. PER MIN.
A
B

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Fig. 1.—Human Thermometric Chart for Determining "Sensible" or Effective Temperatures for Individuals Normally Clothed, from Measurements of Dry-Bulb Temperature, Wet-Bulb Temperature and Velocity of Air

LOW AIR VELOCITIES MORE EFFICIENT THAN HIGH IN COOLING HUMAN BODY

Considering next the efficiency of air movement in cooling the human body, it will be noted in Fig. 1, that low velocities are more efficient than high. The distance between any two consecutive velocity lines is a function of the amount of cooling produced by an increase of 100 ft. per minute in the velocity of the air. Therefore above 300 ft. per minute the efficiency of air movement falls off considerably, and it will be inefficient in practice to use velocities greater than 300 ft. per minute.

In the application of effective temperature to practical problems, where air of high temperature and comparatively low humidity is cooled, and at the same time saturated with moisture by passing it through a humidifier, Fig. 1 affords a simple means of studying in detail the cooling that will result from saturation and movement of the air. In problems involving cooling or heating of the air at constant dew-point, when a detailed study is contemplated, it will be desirable to introduce in the chart a scale of moisture content of the air. For clearness in reproduction this scale is not shown here, because with the chosen distance between the two vertical axes it falls outside the limits of the chart.

EFFECT OF CLOTHING

To indicate the large extent to which clothing decreases the cooling power of wind in such temperatures as are frequently met with in actual practice, Fig. 2 has been prepared with velocity of air as abscissae and cooling in degrees effective temperature as ordinates. The three sets of curves give the relative amount of cooling for three different dry-bulb temperatures, but for the same relative humidity of 50%, and for subjects both normally clothed and stripped to the waist, as indicated in the figure.

At the ordinary dry-bulb temperature of 70°, a velocity of 300 ft. per minute produces a cooling of about 5° on the human body when clothed, and 10.5° when stripped to the waist. Therefore clothing under these conditions reduces the cooling by 52%. Approximately the same percentage reduction holds true for velocities higher than 300 ft., but for lower velocities the decrease in cooling effect is still greater.

With a velocity of 100 ft. per minute, the corresponding decrease in cooling at 70° is 66%. As the temperature of the air increases the percentage reduction in cooling decreases slightly, varying from a maximum of 50% to a minimum of 40%.

In general, the report brings out that normal clothing at ordinary humidity halves the cooling effect of wind, as compared with that obtained when only light work is done and trousers, socks and shoes are worn.

An elastic cotton union suit which will cover tightly as much of the body's surface as possible, constitutes an ideal outfit for exposures to hot atmospheres.

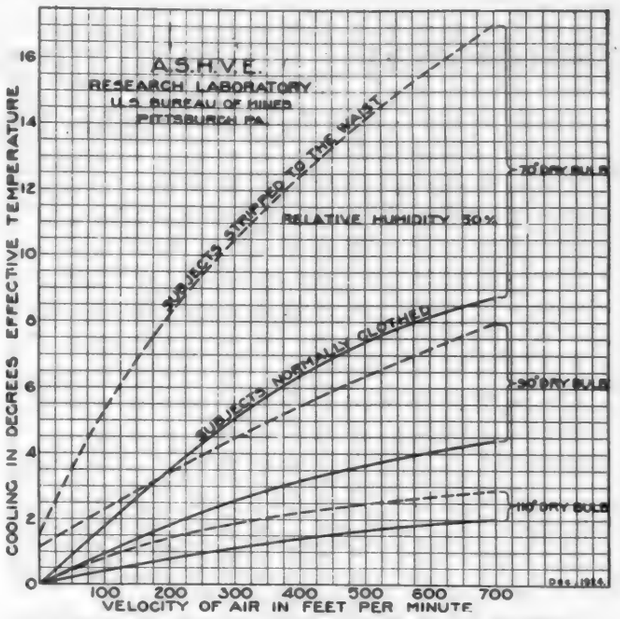

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Fig. 2.—Chart Showing Extent to Which Clothing Reduces the Cooling Effect of Wind at Different Dry-Bulb Temperatures

Clothing, also, should never be removed when the wet-bulb temperature exceeds the temperature of the body. The air in such cases should be kept as still as possible, and the more the clothing the greater the insulation against transfer of heat from the air to the body.

In keeping with the best information available, the experimental data collected in a previous study of the "comfort zone"[5] is converted to the normal scale of effective temperature and the zone superimposed on Fig 1, as shown by the dotted area. It will be observed that when referred to the "normal" scale the comfort zone is included between the 63° and 71° effective-temperature lines, which constitute, respectively, the lower and upper boundaries of the zone.

Strictly speaking, the "comfort line" is represented by the 66° effective-temperature line, which for the range of humidity employed in the comfort experiments corresponds to a basic value of 64.5° effective temperature.

Thus it is left to the judgment of the heating and ventilating engineer to shift the comfort line back or forth according to seasonal variations in the clothing worn. If lighter clothing is worn in summer than in winter, the comfort line will approach the lower boundary of the zone in winter and the upper boundary in summer.

The rate at which clothing transfers heat through it depends upon the material, condition of same with respect to moisture, thickness and size of its meshes. When dry, cotton or woolen clothes of the same thickness and size of mesh are equally good, but when wet, woolen clothes prevent heat loss much better than cotton. In general, it can be stated that other things being equal, the rate at which clothing transfers heat depends upon the amount of air within its meshes and between its layers.

Emotional Excitement and Its Effect on Temperature Rise in Exhaled Air

Interesting Phenomena Observed in House of Representatives During Memorial Exercises for the Late President Wilson

By S. Homer Woodbridge

AS IS well known, the effects of animal life on confined air are made evident in carbon dioxide, aqueous vapor, heat and effluvial accretions yielded to the air. These all increase with vital energy output, whether physical, mental or emotional. Because more reliable than the others, being less affected by extraneous causes, such as variableness in initial humid or other qualities of air as compared with far more fixed gaseous quality, the air changes attending animal life within it are almost universally measured by carbon dioxide increment.

The changes in air contents within auditoriums, due to mental or emotional activity, have been registered by the sudden increase in contained carbon dioxide when, for example, a staged play approaches an exciting climax. So far as known to the writer, no such change has thus far been chronicled in temperature increments. Only when air changes are rapid, as in the case here presented, reducing to a minimum heat absorption by walls and other heat-absorbing surfaces, can the significance of thermal changes approach in reliability those in carbon dioxide content.

Because of the remarkable character of the accompanying chart, as well as the occasion which gave rise to it, and because of the interest it has for students and practitioners of hygiene, the chart and its interpretation are offered for whatever they may be worth.

RECORD OF VENTILATION OF HALL OF HOUSE OF REPRESENTATIVES, DECEMBER 15, 1924.

Rate of air supply to the Hall, 64,000 cu. ft. per minute, each 6-min. supply equalling the cubic contents of the Hall.

Per capita air supply to floor occupants, 69 cu. ft. per minute.

Average per capita supply to floor and gallery occupants, 45 cu. ft. per minute.

Average temperature of air supplied to Hall, 65.4° F.

Temperature of Hall at floor, average, 70.5° F.

Average temperature of air passing through ceiling open ways to loft, 72.25° F. (except for final rise).

Vapor increment per cubic foot in escaping air, 0.25 grains.

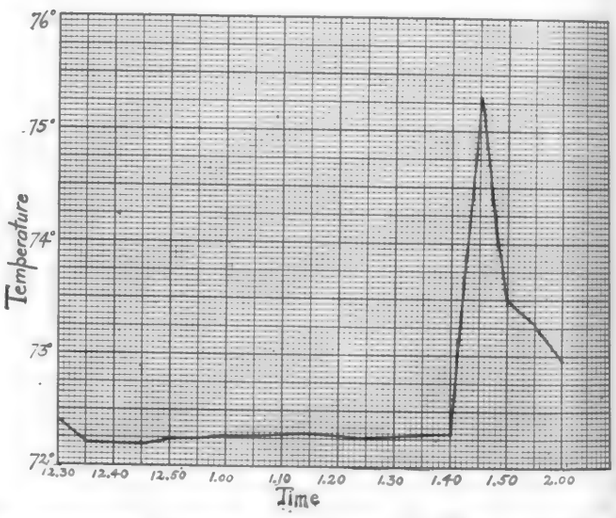
Carbon dioxide increment in escaping air, 2.3 parts in 10,000 of air.

In attendance, approximately, 800 upon the floor, 700 in the gallery.

The above conditions correspond closely with those found during the memorial service in commemoration of the late President Harding, when the Hall was similarly occupied to its utmost capacity, and which the public health expert in attendance reported to be such as to furnish no ground for reasonable complaint as touching the quantity, distribution, quality and effective use of air for ventilating purposes now obtainable within the Hall when so crowded; with the promise of sensible betterment when the newly-acquired and more powerful supply fan shall be installed and the discharge fans speeded to capacity.

INTERPRETATION OF THE TEMPERATURE CHART

Thermometer used in determining temperature, Bureau of Standards (INV 5760 A) graduated to



Temperature Record in House of Representatives During Wilson Memorial Exercises

tenths of degrees. Temperatures recorded at 5-min. and, finally, at 2½-min. intervals.

Exercise and excitement incident to assembling and seating and to the occasion itself had accelerated body heat-production rate within and elimination-rate from the occupants sufficiently to raise the temperature of escaping air to a point not measured. Temperature continued falling with the quieting and relaxation of the assembly until 12:35 when the temperature registered was 72.16°.

Interest in the discourse then began to have its physiological effect, slightly and continuously increasing thermal production and output until, at

1:15, the temperature reached 72.28°. After further intent listening to the address there came slight mental and nervous relaxation attending unconscious fatigue, with accompanying reduction in the rate of thermal production and elimination, and a corresponding fall in air temperature, at 1:25, to 72.25°.

As the address neared its peroration climax, interest became increasingly intense, and the effect on air temperature is seen in the rise, at 1:40, to 72.51°; at 1:42½, to 74.6°; and, at 1:45, to 75.3°. The final temperature rise attended the mental excitement of the closing 2½ minutes, the physical exercise of general and prolonged applause, the rising of the assembly to its feet, releasing warmed air from within clothing, all adding their effects to that of increased thermal body production and output.

Immediately following the close of the address and during subdued music by the United States Marine Band, the temperature began falling rapidly, as shown, toward the normal.

Insulation of Roofs to Prevent Heat Loss and Condensation

(Concluded from last month's issue)

In last month's issue the problem was presented of finding the greatest relative humidity that can be carried under a roof with a resistance of 3.0 and with a heat head of 100°, before condensation will occur, at a room temperature of 70°.

Following were the directions given for solving this problem:

On the Roof Resistance Curve RR (See January issue) locate a point at a height of 3.0 by the resistance scale on the right-hand side of the chart. Draw a line from this point through the lower left-hand corner A. Where this line intersects the horizontal line of 100° heat head, read vertically downward to the humidity curve of the chart. Then pass horizontally to the left-hand edge of the chart where we find that the roof will support a relative humidity of approximately 40% maximum, at 70° inside temperature.

From Table No. 1 (see THE HEATING AND VENTILATING MAGAZINE for November 1924) the resistance for the particular uninsulated roof is 2.289. From the chart the required resistance (3.0) to prevent condensation is obtained.

The difference between these two figures represents the additional resistance (0.711) to be furnished by the application of roof insulation of the proper thickness.

The thickness of the insulation to be applied is determined as follows:

Let X be the internal conductivity (not air-to-air) per degree difference, per hour, per inch thickness of insulation to be used (this figure is a similar unit to that usually given by the United States Bureau of Standards).

Then $1/X = R'$ = internal resistance.

Then $0.711/R'$ = thickness in inches of insulation required, or $0.711 \times X$ = thickness in inches of insulation required to prevent condensation.

WOOD ROOFS

All of the figures given for wood in this article apply to solid wood. In other words, cracks have not been considered. It is readily seen that where there are cracks between the roof board, the humid air will pass up through these cracks and condensation will occur on the under side of the insulation.

To prevent the insulation from thus becoming moist, the specifications for applying roof insulation on wood roofs should state that two layers of roofing felt must be tacked to the wood roof deck, with all joints tightly sealed, before the insulation is applied and mopped in place with hot asphalt.

Condensation may occur in the cracks between the boards beneath the paper, but as a matter of fact, the boards being comparatively close together, the temperature would be greater on the bottom of the insulation than would be the case if there were no boards, on account of radiated heat, and it has been found in practice that this apparent error does not amount to over 10% or 15% in ordinary cases. The addition of 25% in the calculated amount of insulation will undoubtedly take care of the cracks, especially where tongued and grooved boards or splines, are used.

In very extreme conditions, especially with wood roofs under 1½ in. thick, it is best to ignore the resistance of the boards entirely, and supply enough insulation resistance to carry the existing or proposed relative humidity.

Emulsified asphalt has lately been obtainable and since is does not run under 300° F. and can be applied cold (with temperature over 45° F.) directly to the roof boards, the insulation can, after 24 hours, be mopped to it with hot asphalt, thereby making a better job than above outlined by use of roofing felt.

CONCRETE AND TILE ROOFS

With concrete and tile roofs, this application is usually covered by specifications similar to the following:

"The roof deck shall be reasonably smooth, dry, well cured and swept clean before laying the insulation. Coat the roof deck with tar or asphalt into which, while hot, embed the insulation. Butt the joints closely so that the sheets or units shall be practically integral one with the other.

"Traverse joints and joints of successive layers of the insulation should be broken and filled with tar or asphalt. Give the entire surface a full and uniform mopping of hot tar or asphalt, in which, while hot, lay any suitable roofing according to reputable roofing manufacturer's standard specifications."

The use of a high-grade emulsified asphalt is at least, to some extent, taking the place of ordinary hot asphalt or pitch for the following reasons: (a) can be applied cold; (b) does not run and drip from cracks; (c) sets within a few hours and is then waterproof; (d) remains pliable and does not crack with cold temperatures.

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A CLARIFYING distinction as to what is meant by central heating, district heating and community heating has been made by F. A. Combe in his report to the Dominion Fuel Board on the state of the industry, with special reference to its future possibilities in Canada. Central heating is defined as applying to the distribution of heat by means of steam or hot water through a system of underground piping from a central boiler plant to a number of buildings comprising a school, university, hospital, asylum or other institution which is included under one management. District heating is defined as applying to a public utility or independent company furnishing steam or hot water to buildings in a city or town, the heat being purchased in the same manner as electricity, water or gas. Finally, community heating is defined as applying to a block or group of dwellings heated from a central plant, either by private arrangement between the owners, or as a development by a company, selling or renting dwellings under special agreement for heating.

These distinctions appear to be very logical and we see no reason why they should not be generally followed in discussions of centralized heating or distributed heat. In England, "central heating" usually means a system installed in the basement for heating a single building, a term which, no doubt, has arisen from the practice of heating buildings from fireplaces. Misconceptions, however, are likely to arise from the use of this term, while Mr. Combe's definitions are comprehensive and clear.

SPEAKING of heating nomenclature, it is rather remarkable how many terms there are which persist in spite of their lack of clarity, to say nothing of their incorrectness. "Hot blast heating," for instance, is one of those terms which simply grew; it was always intended to refer to fan blast heating. "Hot water heating" is another curious expression which has seemed to be necessary to distinguish between the heating of water for domestic service and the use of hot water for warming buildings. "Warm-air furnace heating" is still another example of tautology "on our list." Many additional terms will readily occur to the reader. Any move to reduce their number and the ambiguity of many remaining in use is well worth while.

Fortunately, most of the terms used in heating work have not had the same origin as those characteristic of the plumbing industry which pertain so much to the human anatomy, so there is plenty to be thankful for. Many, if not most, plumbing terms reflect perhaps too closely the state of the art at the time they were coined and are not by any means terms which would be chosen if the industry had it to do over again.

PROSPECTS of another record-breaking building year, indicated by earlier surveys, are confirmed in an impressive forecast issued by the *Architectural Forum*. The importance of these figures, which are presented on another page, is due to the fact that the estimates received from the same source for the past three years have proved to be within 3% of the actual figures for those years. In the present forecast it is worthy of note that school buildings take first place in the construction program, the figures being $726,858,000. This was the case last year when the total was considerably higher, $802,258,300. Next in line for 1925 come apartments which, if we consider also apartment hotels, come to $782,712,000. This is a change from last year when hotels ranked second in the building program. Other notable changes in the 1925 plans are increases in the amount of new church construction and in dwelling construction, and a decrease in the amounts being expended for community memorials and similar structures. One of the most significant changes is in the theatre building program, which is expected to drop this year from $179,821,700, the 1924 peak, to $135,981,000.

It is remarkable to notice how closely the figures in some classes of construction correspond with those of 1924. Those coming under the heading of "Automotive," for instance, totaling $142,458,000, are within $4,000,000 of the 1924 forecast. Banks are slightly less. Clubs are very close at $321,792,000 for the present year, hospitals are about the same, at $229,038,000 for 1925. Industrial buildings, at $392,367,000, are only $24,000,000 less than last year, office buildings, at $488,619,000, will run close to last year's figures, public buildings at $187,101,000 are ahead of last year some $40,000,000, stores at $137,238,000 will come just below last year's record, while welfare buildings, at $56,640,000, will exceed the previous year's record by $10,000,000.

American Society of Heating and Ventilating Engineers

The Research Laboratory Goes On

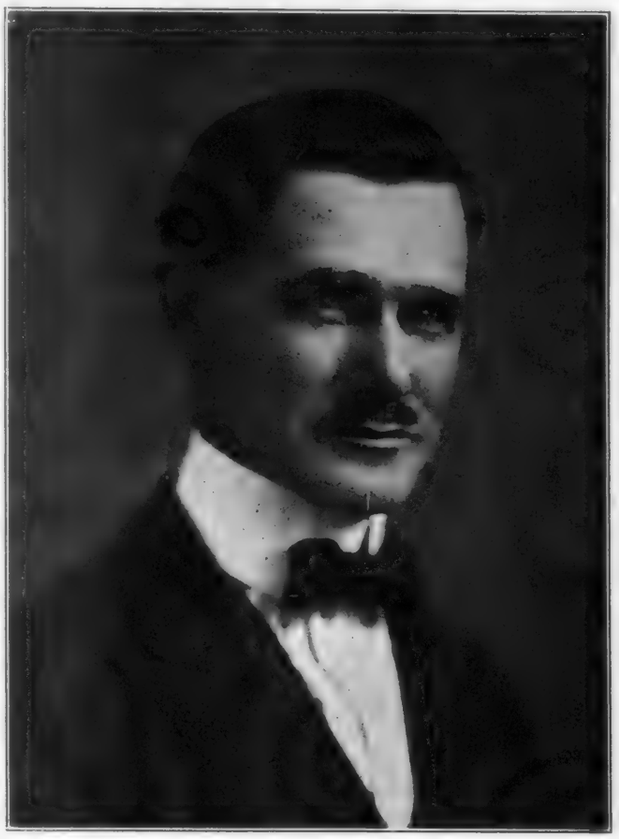
Measures Taken at Heating Engineers' Thirty-First Annual Meeting Insure Permanent Operation of Laboratory as a Major Activity of the Society.

NO ONE need have any further doubts as to the continuation of the A. S. H. & V. E. Research Laboratory, at least on its present scale of operation. This has been attended to by the simple expedient of increasing the membership dues a matter of $10.00, all of which is to be allocated to the Research Laboratory in Pittsburgh.

With a membership of 1800, it will be seen that this increase represents over $15,000 which is the minimum sum required to enable the society to fulfill its contract with the Bureau of Mines.

But this is not all. No sooner had the sentiments of the members been expressed in an overwhelming vote in favor of the increased dues than one manufacturer after another came forward in the meeting with individual subscriptions ranging all the way from $1000.00 a year for five years to $100.00 a year for the same period.

When the smoke had cleared away it was found that the additional subscriptions alone, received at the meeting, totaled nearly $8,000.00 a year. This, with the proceeds from the increased dues, will net the tidy sum of $23,000 which comes within $2,000 of the Research Committee's tentative budget for 1925.



Samuel E. Dibble

New President of the American Society of Heating and Ventilating Engineers. Professor Dibble is Head of the Department of Heating, Ventilating and Sanitation at the Carnegie Institute of Technology, Pittsburgh, Pa.

From the moment that Chairman William H. Driscoll of the Research Committee made his impassioned plea for the Research Laboratory, and Dean F. Paul Anderson, the director of the Laboratory, told of how vital a part it had become in the society's progress, it was clear that their appeals were to carry the day and that the Society was to take no backward step in this important matter.

The additional fact that a poll of the membership showed a vote of 400 in favor of the dues increase, as against 300 opposing votes, was all that was needed to remove the last vestige of doubt as to the general sentiment of the members, and when the vote was taken it was overwhelming. On the motion of one of those who had cast an opposing ballot, the vote was made unanimous.

Irrespective of this momentous action insuring the continued life of the A. S. H. & V. E. Research Laboratory, the meeting itself will go down as one of the most interesting and successful in the history of the society. The attendance was well up to the standard, exceeding the 400 mark, while the papers covered such notable topicts as effective temperatures with clothing, tests on the new Cartridge copper air heaters and new data on water flow through pipes.

The convention arrangements were handled by the Massachusetts chapter of the society in a way that more than met every requirement.

Opening Session, January 27

In accordance with the requirements of the constitution, the business sessions of the annual meeting were held in New York, at the Engineering Societies Building. A score or more of members were present Tuesday morning when President Homer Addams called the meeting to order. All of the reports, however, with the exception of the tellers' report, were put over to one of the later sessions, in Boston. In the matter of the proposed amendment to increase the dues, after considerable discussion, it was voted to adjourn the business session to the following Saturday, when final ac-

tion was to be taken on the matter. It was reported that a straw mail ballot had shown 400 of the members in favor of the increased dues, and 300 members opposed. While this vote showed a majority in favor of the increase, it was felt that the sentiment at the annual meeting should be obtained before bringing the matter to a final vote.

Chairman Frank G. McCann, of the Tellers' Committee, reported the result of the election of officers, which was of unusual interest in view of the fact that two candidates for president were in the field. He reported that the regular candidate, L. A. Harding, had received 284 votes, while the independent candidate, Samuel E. Dibble, of Pittsburgh, had received 498 votes, making him the new president.

President Addams then declared the election of the new officers, as follows:

NEW OFFICERS

President, Samuel E. Dibble, Carnegie Institute of Technology, Pittsburgh, Pa.

First vice-president, William H. Driscoll, New York.

Second vice-president, Dean F. Paul Anderson, director of the A. S. H. & V. E. Research Laboratory.

Treasurer, Perry West, Newark, N. J.

Council: Homer Addams, New York; W. H. Carrier, Newark, N. J.; J. A. Cutler, Chicago; W. E. Gillham, Kansas City, Mo.; Thornton Lewis, Philadelphia; William T. Jones, Boston; J. H. Walker, Detroit; Professor A. C. Willard, Urbana, Ill.

Research Committee: William H. Driscoll, New York; Charles V. Haynes, New York; H. M. Hart, Chicago; Perry West, Newark, N. J.; J. I. Lyle, Newark, N. J.; and (to serve unexpired term of one year) Walter S. Timmis, New York.

Morning Session, January 28 (Boston)

All of the professional sessions in Boston were held in the Swiss Room of the Copley-Plaza Hotel. Chairman Alfred Kellogg of the Massachusetts Chapter's Entertainment Committee, expressed the welcome of the Boston members. He then presented Mark Sullivan, corporation counsel of Boston, who spoke for Mayor Curley.

Mr. Sullivan referred to the serious illness of Mayor Curley's daughter which prevented him from being present. He paid a tribute to the place achieved by the heating and ventilating profession and cited particularly the advances made in the way of improving the character of heating installations through the adoption of "certified heating" by the heating contractors.

He said the great need of the day is to bring the work and aims of the heating and ventilating engineer closer to the general public. "You need to make a closer contact" he declared, "with the people whose co-operation you must have to accomplish your aims."

Mr. Kellogg responded to Mr. Sullivan's welcome. President Addams then took the chair. He asked the members to stand a moment with bowed heads as a gesture of respect to the memory of Secretary Houghten's father who died the previous day. Secretary Houghten was obliged to leave the meeting, his place being taken by A. V. Hutchinson the society's manager of publications.

President Addams then delivered his address in which he spoke of the need of greater support for the society's Research Laboratory, the status of the proposed Code of Minimum Requirements for the Heating and Ventilation of Buildings, and the progress of the work in formulating a standard exhaust code. The *Journal*, he said, being published now on a monthly basis, has taken its place as one of the important technical periodicals in its field.

President Addams spoke glowingly of the success of the A. S. H. & V. E. Guide, 1924-1925. The Transactions for 1922–1923 have been published and sent to the members, while the Transactions for 1923–1924 are almost ready for publication. This, he said, brings the society's Transactions up to date for the first time since 1918.

President Addams cited the expressions of a number of past presidents, including Stewart A. Tellett, Rolla C. Carpenter, Henry Adams, J. H. Kinealy, and Andrew Harvey, to show how well the society had fulfilled their aspirations. He concluded by echoing the suggestion once made by Andrew Harvey that one of the society's meetings be held in Europe. This, he said, which was then considered such a far cry, may yet come to pass.

The report of the council showed the society's affairs to be in good condition.

The secretary's report mentioned the fact that with the Northwest Pacific Chapter the society now has fifteen chapters. He gave details of the society's financial standing which showed the general fund to be 50% higher than last year. 255 members were elected during the year, bringing the present total membership to 1897. In addition the society has applications on hand which, if favorably passed on, will bring the membership to the 2000 mark.

The morning session concluded with a paper by Davis S. Boyden and A. B. Williams on "Heating and Ventilating the Modern Steam Power Station." The paper dealt with the construction and equipment of the Weymouth Power Station of the Edison Electric Illuminating Company of Boston, and described in detail the means taken for the ventilation of the station, especially for the reduction of excessive temperatures and the removal of smoke. A number of lantern slides were shown which were explained by A. B. Williams.

It was brought out in the discussion how important a part is being played by heating and ventilation in connection with the design of power plants.

Afternoon Session, January 28

The entire session Wednesday afternoon was devoted to a discussion of the society's proposed Code of Minimum Requirements for the Heating and Ventilation of Buildings.

Thirty minutes were devoted at the outset to a general discussion of the code, the general trend of which was that the mandatory provisions of the code be separated from the rules and methods for meeting these provisions. A committee was appointed, consisting of C. A. Booth, W. H. Carrier, J. D. Cassell, W. S. Timmis, W. L. Fleisher, Stewart A. Jellett and L. A. Harding, to draft a resolution to accomplish this separation.

Discussion then proceeded on the code beginning with Section 3, dealing with minimum requirements for estimating the heat required for warming, which has been so widely discussed. Professor A. C. Willard, chairman of the committee on this section, stated that the comments and criticisms could be summed up in the statement that the section should be condensed and the requirements made mandatory, that one value be given for each coefficient or constant, with the hope that they would harmonize with those of the Heating and Piping Contractor's National Association, that a table of heat losses be arranged which will give one value for each constant, that the outside weather basis be left the same, that the code be published in loose-leaf form and that, finally, measures be taken to secure the co-operation, in the completion of the section, of the Heating and Piping Contractors' National Association, the American Society of Refrigerating Engineers and the National Research Council.

Another section which aroused a lengthy discussion was Section 6, dealing with the rating of steam and water heating boilers. This section was presented by sub-committee chairman J. F. McIntire. An animated discussion of manufacturers' boiler ratings brought out the statement that the committee had now incorporated in this section all of the conditions under which such boilers were to be rated, so that, knowing these conditions, the engineer or contractor could make due allowances in selecting a boiler for any given installation.

Boiler manufacturers, it was stated, will never agree on a uniform method of rating a boiler, but if the society in its code lays down the conditions which must control boiler tests, and if the boilers are so tested and stamped with the A. S. H. & V. E. plate indicating that they have been so tested, the engineer or contractor can take the catalogue ratings as published and determine the size required, even though the manufacturers' rating may fall considerably below the rating actually selected.

For Section 10 on pipe sizes for water heating systems, Professor F. E. Giesecke presented a new text for this section based upon his investigations at the University of Texas and at the University of Illinois. This revision, stated Walter S. Timmis, chairman of this section, will be substituted for the present section.

At the conclusion of the Session, President Frank A. Merrill of the Heating and Piping Contractors' National Association, was presented and extended the greetings of that organization.

Wednesday Evening Session, January 28

Society matters occupied the first part of the evening session. Reports on the growth in membership were made by Alfred Kellogg and C. V. Haynes. Mr. Haynes reported that new chapters of the society are being proposed for Los Angeles, Atlanta, Cincinnati, and Hartford, Conn.

In connection with complaints that applicants for membership had to wait an undue length of time for action on their applications, a resolution was offered by A. M. Lane providing for the approval of membership applications by the various chapters, so that the Membership Committee can act on the applications without having to go back of the Chapter's endorsement.

The improved financial condition of the society was shown in the form of slides of balance sheets, etc., which were explained by Thornton Lewis. The figures indicated an increase in the net profits of the society of $11,000 over last year. Both in strictly society operations and in the publication department, the balances were on the right side of the ledger.

Regarding the A. S. H. & V. E. Guide, the Publication Committee made the important suggestion that the Guide be published every two years, instead of annually as at present. It was proposed to increase the advertising rates in the Guide 50%.

The presence of Calvin S. Rice, secretary of the American Society of Mechanical Engineers, led to an invitation to have him address the meeting. Mr. Rice stated that he spoke officially for president Durand in suggesting a joint meeting of the American Society of Heating and Ventilating Engineers and the American Society of Mechanical Engineers.

A paper on "Effective Temperature Upon the Friction of Water in Pipes," was presented by Professor F. E. Giesecke, of the University of Texas.

Effect of Temperature Upon the Friction of Water in Pipes

Professor Giesecke called attention to the fact that in calculations relating to water heating, especially for forced circulation systems, it is important to know how the friction varies with the temperature of the water. This point, he said, is one that has not been given much attention as most of the data has been secured for application to general hydraulic problems.

It is now quite generally understood, he said, that the friction of water in pipes may be determined by the formula

$$h = f \frac{l}{d} \frac{v}{2g}$$

where h = friction head in feet of water.
l = length of pipe in feet.
d = diameter of pipe in feet.
v = velocity of water in feet per second.
g = acceleration due to gravity in feet per second each second.
f = dimensionless factor whose value depends on the character of the pipe, the velocity of the water, the diameter of the pipe, the density of the water and the viscosity of the water.

So far it has been impossible to describe the character of the pipe surface in mathematical terms; for that reason any one discussion of this formula should be limited to one particular kind of pipe, such as commercial black iron pipe, commercial galvanized-iron pipe, or to smooth brass tnbing, etc. In that event, the value of f depends only on the diameter of the pipe and on the velocity, density and viscosity of the water.

In ordinary hydraulic calculations the range of temperature of the water is small and hence the density and viscosity of the water are practically constant and f may be assumed to vary only with the diameter of the pipe and with the velocity of the water. For that reason textbooks on hydraulics give tabular values of f based only on the diameter of the pipe and the velocity of the water.

When the range of temperature is so great that there is an appreciable change in the density and viscosity of the water, these two factors must be considered and the four factors, which determine the value of *f*, must be combined in such a manner that the combination is dimensionless.

The four factors are expressed in the following units:

velocity, in feet per second (ft. sec.$^{-1}$)
diameter in feet (ft.)
viscosity in pounds per foot sec. (lb. ft.$^{-1}$ sec.$^{-1}$)
density in pounds per cu. ft. (lb. ft.$^{-3}$)

These four quantities can be combined in a number of different ways, but only the following combination will result in a dimensionless quantity:

$$\frac{\text{velocity} \times \text{diameter} \times \text{density}}{\text{viscosity}} = \frac{\text{ft. sec.}^{-1}\ \text{ft. lb. ft.}^{-3}}{\text{lb. ft.}^{-1}\ \text{sec.}^{-1}}$$

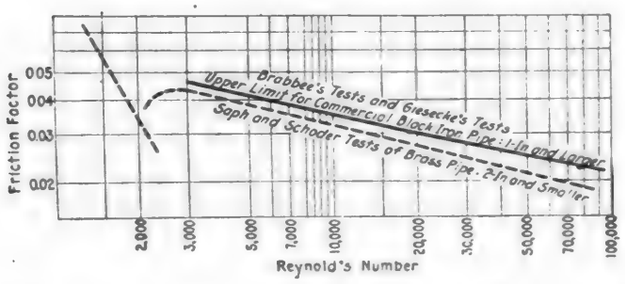


Fig. 1.—Relation of Friction Factor to Reynold's Number

Since the density and viscosity of the water vary simultaneously with the temperature of the water, the two factors may be combined into one.

Prof. Osborne Reynolds suggested the name "Kinematical viscosity" for the ratio of viscosity to the density. Following this suggestion we have:

$$\text{Kinematical viscosity} = \frac{\text{viscosity}}{\text{density}} =$$

$$\frac{\text{lb.ft.}^{-1}\text{sec.}^{-1} = \text{ft.}^2\text{sec.}^{-1}}{\text{lb.ft.}^{-3}}$$

The expression $\frac{\text{velocity} \times \text{diameter}}{\text{kinematical viscosity}}$ is known as Reynold's number and is so designated in this paper.

The character of the relation of f to Reynold's number has not yet been determined and until it shall have been, recourse must be had to experimental determinations.

Professor Giesecke told of a number of experiments, including some of his own, to show that the relation of the friction factor, f, to Reynold's number, depends on the diameter of the pipe, as well as its character, and that the value of f decreases as the diameter of the pipe increases.

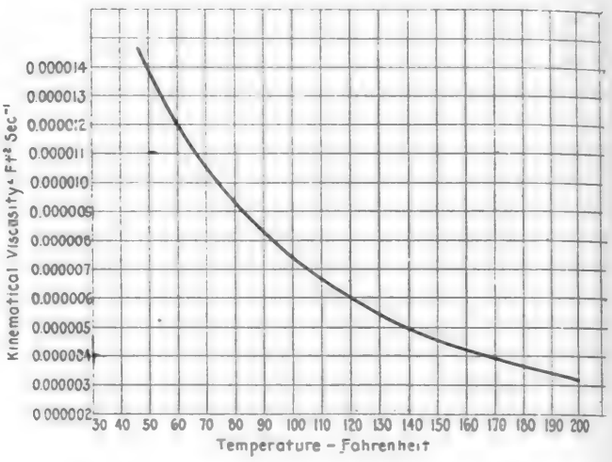


Fig. 2.—Kinematical Viscosity of Water

To show how the data available at the present time may be applied to determine the effect of temperature upon the friction of water in pipes, he presented Fig. 2 and an accompanying table, giving the kinematical viscosity of water at various temperatures. To explain the application of the data to the solution of practical problems, he offered the following example:

Let it be required to find the friction-head in a 1-in. black iron pipe when the water is flowing with a velocity of 2 ft. per second, and when the temperature is (a) 60° F., or (b) 180° F.

The diameter of a 1-in. pipe is 1.049 in. or 0.0874 ft. Reynolds' number for the two cases are:

$\frac{2 \times 0.0874}{0.00001207}$ or 14,500 and $\frac{2 \times 0.0874}{0.00000362}$ or 48,300

and the corresponding values of f (from Fig. 1) are 0.032 and 0.025.

The corresponding friction-heads are (from the formula given) 0.023 ft. of 60° water and 0.018 ft. of 180° water, per foot of pipe, a difference of 24%. Figuring the friction-head as the loss of pressure in pounds per square inch gave a similar result.

The concluding paper of the evening session was on "Industrial Application of Ozone," by F. E. Hartman, of the U. S. Ozone Company. After presenting the paper, Mr. Hartman made the significant statement that ozone has a definite and specific place in the heating and ventilation of build-

ings. "It has already achieved a firm and well-intrenched place in our scheme of ventilation," he declared.

Morning Session, January 29

Thursday morning's session was featured as a Research Session. It was opened with the presentation of two papers on dust determination, one by Miss Margaret Ingels on "The A-A Dust Determinator," and one by Philip Drinker on "The Use of Owen's Jet Dust Counter and of Electric Precipitation on the Determination of Dusts, Fumes and Smokes in the Air."

The A-A Dust Determinator

This paper contained a simplified chart for use in connection with the A–A dust determinator developed at the A. S. H. & V. E. Research Laboratory and described at the society's January, 1924, meeting.

As was brought out in the paper, the most difficult problem to solve in the development of a dust determinator is the relation between the amount of dust deposited on the filter medium and the increase in resistance across the filter medium, and to determine the effect of the initial resistance on this relation. The principal criticism of the determinator in its previous form was that it only took into account very small particles of dust.

The second part of the paper describes the development of the A–A dust determinator to measure the larger dust particles.

THE RESEARCH LABORATORY

Chairman William H. Driscoll of the society's Committee on Research then took the floor and in an address which many considered his master effort, he showed how the Research Laboratory had become the vital element in the society's progress. During the period of its existence he declared, the society's membership has been doubled and the number of chapters increased from eight to fourteen. He pleaded for the continued support of the laboratory on the broad ground of patriotism, and urged the members to live up to their title of being the "American" Society of Heating and Ventilating Engineers.

He reminded the members that the society's contract with the Bureau of Mines calls for the expenditure of $15,000 a year. Last year the amount expended was $23,000 and this year's budget has been fixed at $25,000.

The laboratory, he said, must have a basic income. The increase in the membership dues, as proposed, would yield an income of $15,000 and he expressed the utmost confidence that, if this amount was forthcoming, the former subscribers to the laboratory among the manufacturers would rally again to its support.

Mr. Driscoll's address was received with marked enthusiasm and when Dean F. Paul Anderson arose to give his address, the assemblage rose to him to a man.

Dean Anderson made one of his characteristic addresses. Human relations, he declared, are the most important things on this planet and co-operation is the most important thing in promoting human relations. The A. S. H. & V. E. Research Laboratory, he said, has had more to do with putting the other technical societies on their metal than any of the members realize.

Life, continued Dean Anderson, is a matter of research. We are all interested in research and in the Research Laboratory. We would not be here if we were not. There is no question of that, he said. The only question is the form that interest is to take.

We are all trying to find out what God intended

Dean F. Paul Anderson Who Continues as Director of the A. S. H. & V. E. Research Laboratory

with all the natural laws and research is simply the striving to find out what these laws are.

Research, he said, very often has no immediate value. Many of the most important scientific discoveries of all time have not been utilized for generations after their discovery.

Dean Anderson instanced the work of such original investigators as Galileo, Newton, and in our own time, of Edison and DeForest, in unlocking the door of Nature's secrets. Galileo's discovery of the principle of the pendulum, through his observation of a swinging chandelier in an Italian church was cited, the observation being made by Galileo that

the time of the chandelier's swing was not affected by the length of the arc. He gave instances of many other discoveries of fundamental laws which resulted from simple research experiments of scientists.

Newton did not discover gravity through the falling of an apple on his head. He had long studied the phenomenon of gravity and when his law was finally enunciated it could be attributed directly to his long-continued researches.

Men, concluded Dean Anderson, grow larger through studing Nature's laws. Moreover, research makes men work better with each other. We are to-day, he said, passing through a period, in connection with radio, which is the outcome of a long period of the most patient and painstaking research.

It was very evident, long before Dean Anderson finished, that he had thoroughly won his audience and when he finished his address he was given long-continued applause.

President Addams voiced the feelings of the assemblage when he stated that the case of the society's Research Laboratory had been presented in a way which called for no further word.

A vote was then called for on the sentiment of the members present as to the proposed increase in dues. A number of proposals were made as to substitute methods of raising the necessary funds. In reply, J. I. Lyle expressed the situation very clearly when he stated that the lack of support of the Laboratory on the part of the majority of the members had been the cause of the present situation and that the continued existence of the Research Laboratory depended upon the adoption of the amendment.

In response to calls for the question, a vote was taken on the sentiments of the meeting, and the proposed amendment was endorsed with few dissenting votes. A motion to make the vote unanimous was carried with cheers.

Immediately upon the announcement of the vote Warren Webster arose to announce a subscription of $1000 per year for a period of five years for Warren Webster & Company, of Camden, N. J., and of an additional five-year subscription of $250 from the Fulton Company, of Knoxville, Tenn.

Charles V. Haynes announced a $1000 five-year subscription from the Hoffman Specialty Company, of Waterbury, Conn.

Cheers greeted each of these announcements.

Half a dozen men sprang to their feet to offer additional five-year subscriptions. These when finally compiled and announced at the society's dinner, held the same evening, were as follows:

Warren Webster & Co., Camden, N. J.....	$1,000.00
Hoffman Specialty Co., Waterbury, Conn...	1,000.00
Buffalo Forge Co., Buffalo, N. Y.....	1,000.00
B. F. Sturtevant Co., Hyde Park, Boston, Mass.....	1,000.00
General Electric Co., Schenectady, N. Y....	500.00
Johnson Service Co., Milwaukee, Wis.....	500.00
Midwest Air Filters, Inc., New York.....	500.00
Fulton Co., Knoxville, Tenn.....	250.00
Monarch Metal Products Co., St. Louis, Mo.	250.00
Carrier Engineering Corp., Newark, N. J....	250.00
Reed Air Filter Co., Inc., Louisville, Ky....	250.00
Excelso Specialty Works, Buffalo, N. Y.....	250.00
Thermal Appliance Co., New York.....	250.00
Nash Engineering Co., So. Norwalk, Conn..	250.00
John J. Nesbitt, Inc., Atlantic City, N. J....	150.00
Dr. Alice G. Bryant, Boston, Mass.....	100.00
Fowler & Wolfe Mfg. Co., Philadelphia, Pa..	100.00
York Heating & Ventilating Co., Phila., Pa..	100.00
Langenberg Mfg. Co., St. Louis, Mo.....	100.00
Frederick D. Mensing, Philadelphia, Pa....	100.00
Total	$7,900.00

Owing to the lateness of the hour the remaining research papers were presented in abstract or by title.

Willis H. Carrier presented the paper on "Equivalent Conditions of Temperature, Humidity and Air Movement Determined with Individuals Normally Clothed (Effective Temperature with Clothing) by C. P. Yagloglou, assisted by W. Edw. Miller.

(This paper is presented in abstract on another page of this issue).

The other research papers were:

"Basal Metabolism, Before and After Exposure to High Temperatures and Humidities," by Dr. W. J. Connell and C. P. Yagloglou.

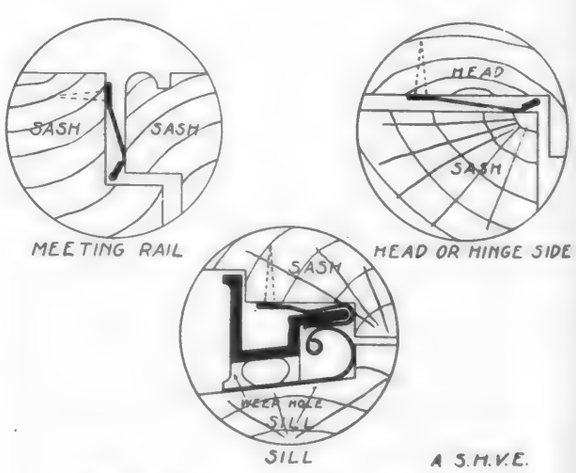
"Work Tests Conducted in Atmospheres of High Temperatures and Various Humidities in Still and Moving Air," by Dr. W. J. Connell and C. P. Yagloglou, assisted by W. Edw. Miller and W. B. Fulton.

"A Progress Report of the Critical Velocity of Steam Flow in Two-Pipe Systems." Work done by Louis Ebin and Gordon H. Eisenhart. Work done by Miss Margaret Ingels.

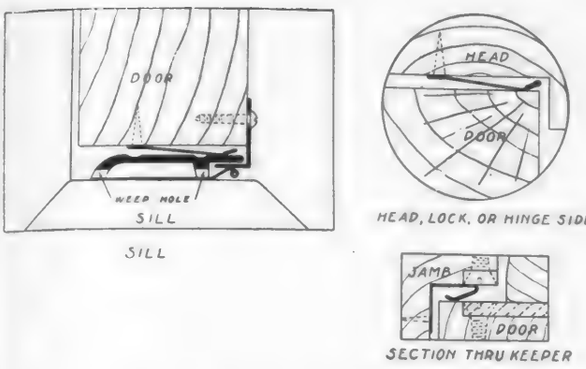
Further Data on Infiltration of Air through Building Openings

By C. C. Schrader

In this paper, which is supplementary to two previous papers, appearing in the Journal of A.S.H.V.E., February and June, 1924 and abstracted in THE HEATING AND VENTILATING MAGAZINE for February and July, 1924, there are some interesting results of tests made on doors, and



Double Casement Weather Stripping



Details of Door Weather Stripping Equipment

double-casement windows, plain and weather-stripped.

Casement windows and doors, whose positions are fixed in the openings, have cracks which may differ throughout, so therefore only a few of the main conditions were tested. The savings in these cases by using weather strips were shown to be very great. For example: tests on plain doors, without weather strips, with 1/16 in. clearance, bottom 1/16 in. to ⅛ in. and top and lock side cracks of 1/16 to ¼ in. gave an average infiltration of 20 cu. ft. per hour. per foot per mile and 24.6 B.T.U. (at 70° F. temperature difference) per cubic foot per hour per foot per mile, while for the same door weather-stripped, under the same conditions, the infiltration was 0.52 cu. ft. and 0.655 B.T.U. temperature difference of 70° F.

Tests on double inswinging casement windows with a clearance of 1/16 in., top and bottom cracks ranging from 1/16 to ¼ in. and meeting rail cracks ranging from ⅛ to 5/16. in., showed that the infiltration averaged 11.5 cu. ft. per hour per foot per mile and 14.5 B.T.U. at 70° F. temperature difference per cubic foot per hour per foot per mile, while for the same casements, under the same conditions but weatherstripped, the infiltration averaged 0.5 cubic feet and 0.72 B.T.U.

As the author states, accurate data concerning infiltration and the proper application thereof are essential in the calculation of heating requirements. The most important factors in determining the amount of heating required on account of infiltration are the sizes of cracks around openings, the wind velocity, and the outside temperature. Two of these factors, namely, wind velocity and temperature, are beyond control. The third factor, crack size, can be controlled only to a very limited extent.

On the calculation of heating requirements for buildings with plain windows and doors, the part required to heat the inleaking air is a large percentage of the total requirements. An extreme condition present in any one of the three factors mentioned causes an increase in this percentage. Extreme conditions simultaneously in all three factors raises this percentage to such an extent that the heating system fails to meet this overload.

Morning Session, January 30

Friday morning's session was opened with the presentation by Professor A. C. Willard, of a paper on "Basing Warm-Air Heating Selections on Climatological Conditions and Heater Performance Curves," written by Professor V. S. Day.

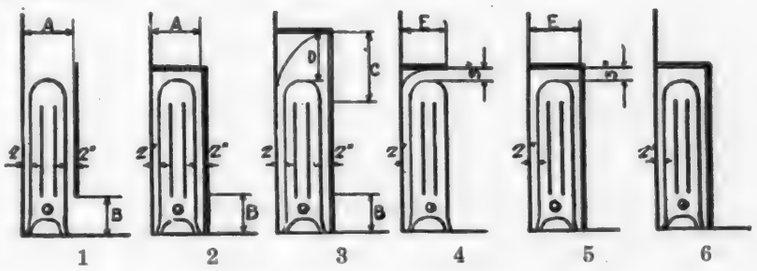
R. V. Frost presented a paper on "Some Facts About Enclosed Radiation."

Some Facts About Enclosed Radiation

In his paper Mr. Frost took up in detail various types of enclosed direct radiation, some of which were the subject originally of a paper by George F. Stumpf, Jr. published in THE HEATING AND VENTILATING MAGAZINE for May, 1914. Mr. Frost has the following to say about the six types shown: Case 1 has a solid panel in front of the radiator and is open at the top and bottom. It is a type that is very useful in schools, offices and churches, where it is desired to protect nearby persons from the direct heat of the radiator. It can be made fully 10% more effective than a direct radiator.

In this type of enclosure there is but one thing to keep in mind. The dimension B must be made large enough. It is not known what the minimum size may be but for safety the opening ought not be less than 80% of the free area of the outlet air passage.

Case II is practically the same as Case I except for the resistance offered by the grills. Some people are afraid of this type of enclosure, but it really is a very effective one, providing the free area through the grills are made ample for free circulation. Many grills are so designed that the net air space is less than 50% of the gross area of the grill. In such a grill trouble is sure to result unless the gross area allows for the restriction.



Types of Enclosed Radiators Discussed by Mr. Frost

Case III is not radically different from Case II, but care must be taken that dimensions D and C are sufficient and that a smooth easy curve is provided on the back lining, so that the change in direction of air movement need not retard the velocity of air flow. As dimension D is increased, dimension C may be reduced until it equals dimension A of Case II. Dimension D, to give good results,

Comparative Heating Effect of Enclosures on Direct Column-type and Indirect Type of Radiators

Radiators Used: Two Peerless 2-Col. Direct Type of Equal Size, 14 sec. 26 in. Two Excell, Jr. 2-Col. Fin-Type of Equal Size, 9 sec., 8 sq. ft.

Enclosures: For column-type: Wood box ⅞-in. thick, lined with ½ in. asbestos and bright tin. Open at top. 5-in. space at bottom. 35½ in. long, 29 in. high, 10 in. deep. For fin-type radiator: Wood box ⅞ in. thick, lined as above. Open at top. 3-in. space at bottom. 44 in. long, 35 in. high, 12 in. deep.

								First Hour			*Last Hour*			*Total*		
Date of Test	Radiator	Surface sq. ft.	Enclosure	Length of test hours	Outside temp. deg. F.	Room Temp. deg. F. Start	Room Temp. deg. F. Final	Temp. Rise deg.	Cond. Lbs.	Temp. Diff. Steam-Air	Temp. Rise deg.	Cond. Lbs.	Temp. Diff. Steam-Air	Temp. Rise	Cond. Lbs.	Temp. Diff. Steam-Air
12	Peerless .	52½	Enc.	5	62	68	94	17	10.25	132	1.5	9.36	123	26	48.5	635
			Bare			74	95	12	10.45	131	1.5	9.72	122	21	51.14	629.5
	Excell. ..	72	Enc.			72.5	92	11.5	8.7	133	1.5	7.7	125	19.5	41	643
			Bare			73	91.5	11	9.26	133	1.5	8.73	125.5	18.5	44.5	644.5
13	Peerless .	52½	E	7	48	61	95.3	24.5	10.48	131.5	0.5	8.87	121.5	34.5	67.38	876.5
			B			60	97	26	10.86	131	0.5	9.66	120	37	71.10	870
	Excell. ..	72	E			57	93.5	26.5	8.83	133.5	0.5	7.85	123.5	36.5	58.2	891.5
			B			57	94	26.5	9.7	133.5	0.5	8.9	123	37	64	889.5
14	Peerless .	52½	E	7	52	59.5	98.5	27.5	10.11	130	1.0	8.69	118.5	39	65.26	864.5
			B			58	96	26	11.08	133	1.0	9.71	121	38	72.1	883.5
	Excell. ..	72	E			60	94	24	8.85	133	1.5	7.82	122	34	57.4	891
			B			58.5	94.5	25	9.54	133.5	1.5	8.46	122.5	36	62.1	892
16	Peerless .	52½	E	6	64	70.5	99.5	19	9.74	127.5	1.0	8.66	117.5	29	54.8	730
			E			69.5	98	19.5	10.49	128	1.0	9.43	119	28.5	59.3	736.5
	Excell. ..	72	E			69.5	95	17	8.34	130.5	1.0	7.40	122	25.5	46.9	753
			B			70.5	96	15.5	8.73	131	1.0	8.55	121	25.5	51.5	754.5

should not be less than the width of the enclosure. This type of enclosure can be made equally as effective as a direct radiator and even more so on some installations. The writer has used this type on a number of occasions and always with excellent results.

Case IV is a very common type, especially for window radiators under a seat and is apt to be misused. A broad shelf over a radiator, if set close to the top of the radiator, is about as effective as a blanket in stopping the emission of heat. If the shelf covers but a portion of the radiator, say one half, the reduction in capacity is probably not more than 10%, but if the shelf extends out beyond the front of the radiator, say from one and one-half to twice its width, then the reduction probably runs as high as 35%.

Case V is parallel to Case IV, but the grill over the front of the radiator reduces the heating capacity in varying percentages in ratio to the reduction in free area.

Case VI is equivalent to a direct radiator except for the retarding effect caused by the resistance of the grills to free circulation. This ought not to exceed 5%, but undoubtedly goes as high as 20%, or even more when some types of grills are used.

The author also speaks of an adaptation of Case VI used by W. H. Driscoll in which a close-fitting sheet-metal casing was placed about the radiator so that it rested upon the lower hubs and extended up to the upper grill. The air then entered through the front grill, passed down to the bottom of the radiator outside the casing, and then over the heating surface of the radiator and out through the upper grill. This scheme obviates the construction of an expensive insulated lining and allows the architect a greater freedom in the design of the enclosures.

From the outline of the six cases the author notes that the most important factors to be considered by the architect are to select grills that have a free area sufficient for the condition and to design the deflectors so that the change in direction of the air flow can be effected with the least loss in velocity.

The character of the metal surface states Mr. Frost, is of greater importance than the insulation which is used to prevent warping of the wood casing. If the metal lining has a polished reflecting surface, such as bright tin or a good quality of sheet tin, properly installed, the effectiveness of the heating surface is appreciably increased.

Mr. Frost then showed how the values given for the various types differ from those given in the Book of Standards of the Heating and Piping Contractors' National Association, the other, a trade data book.

The paper concludes with figures from a test at the Institute of Thermal Research of the American Radiator Co., Buffalo, N. Y. on enclosed radiation.

A group of four rooms were used, of equal size and having exposures both inside and out of the building. Uniform temperatures were maintained in all adjoining rooms, on all sides, and above and below. The outside exposure was to the north toward an open field. The walls were brick and the windows all of the same size. The rooms were about ten by twelve in size, with 9-ft. ceilings.

The radiators used were two-column direct type of equal size and two fin-type indirect radiators of equal size. The radiators selected were chosen because their space dimensions are about equal. Two enclosures were provided, one for each of the two types of radiators tested, the enclosures being identical in every detail.

In making the tests, one radiator was set in each of the four rooms and the condensation and temperature data from each room recorded. Since the exposure in all four rooms was equal, the room temperatures and condensation weights were the only variables.

To make the tests uniform, the radiators were interchanged each day so that the same radiator did not occupy the same room twice, and the radiators were set against an interior wall in order to guard against excessive loss to the outside.

During the first hour, and also during the total time of the test, the temperature rise, with but two exceptions, was higher in the room containing the radiator enclosed than in the room containing the same radiator bare. But also note that the condensation was in every test higher for the bare radiator as compared to the same radiator enclosed, the percentage of increase being approximately 10%. Were it not for this observation, it would at once be concluded that the bare radiator has about 10% greater heating capacity than the enclosed, but here we are confronted with the fact that the enclosed radiator, although condensing less steam, has in the majority of cases given a higher temperature rise to the room. This is the most important phenomenon and one that should be given the most thorough scrunity.

Some light may be given by the fact that this condition could be produced by the use of a bright lining in the enclosure. Galvanized linings, black iron linings and paints of various kinds were used, but tin seemed to be the only thing that would turn the trick. An explanation offered is that the reflecting surface of the tin lining stopped the flow of radiant heat from the radiator and threw it back to be more effectively taken up by the air in convection and so given out as sensible heat to the air in the room. It is for this reason that the enclosures of the type of Cases I, II, III are given higher effective values than Cases IV, V, and VI.

A further point worth noting is that the enclosure E was rather tight fitting to the radiation, there being but ½ in. excess space between the radiator and the casing at the front and back and practically no excess in the length. On the 16th this casing was compared with one having more space all around (marked E^1) and found that the larger casing did not seem any more effective than did the bare radiators on the previous day's tests. This would indicate that the casings should be tight fitting to the radiators.

Finally, while the indirect radiator enclosed showed on but one occasion a temperature rise equivalent to the column radiator enclosed, the column radiator showed in every case, a condensation rate from 15% to 20% greater than the indirect, a saving worth thinking about.

The author makes the comment that the present method of testing radiation by which only the condensation is measured is very incomplete and he advocates a method that will cover all modes of radiation, heat transfer, conduction and convection.

Commenting on the types of inclosed radiators shown, Frederick L. Moesel, author of the series of data sheets on inclosed radiators which have recently appeared in THE HEATING AND VENTILATING MAGAZINE, makes the comment that in Case 1, the height of the lower opening must not be greater than about 6 in., or the purpose of the shield will be defeated for 3 and 4-column radiators. In Case III, the shield at the top of the radiator would usually be fitted much closer to the radiator top making the opening C less than half of that shown.

Case IV, he says, is seldom used. Commenting on case VI, he makes the statement that as a rule, architects will not allow for as great a grill area as that shown.

Another important paper presented at this session was on "Characteristics of an Air-Tube Heater," by L. R. G. Bousquet and G. A. Foisy, of the U. S. Cartridge Company. This paper which will be presented in abstract in a later issue, described an exhaustive series of tests on the recently-developed Cartridge air heater, described in THE HEATING AND VENTILATING MAGAZINE.

Afternoon Session, January 30

Small-sized anthracite coal for house-heating boilers came in for a lengthy discussion at the concluding session, Friday afternoon. One of the papers presented was on "Heat Transference and Combustion Tests in Small Domestic Boilers," by H. W. Brooks, N. L. Orr, W. M. Myler, Jr., and C. A. Herbert. The other paper, by D. Knickerbocker Boyd, dealt with "Designing and Planning for Home Heating Economics, with Special Reference to Anthracite Utilization."

The Entertainment

Under the direction of General Chairman Alfred Kellogg, the Massachusetts Chapter carried out an entertainment program which furnished many delightful hours to both members and guests. Tuesday evening the society's officers and members of the council present were the guests of the Massachusetts Chapter at an informal dinner at the Copley-Plaza Hotel. Later, on the same evening, the convention party was entertained in the Swiss Room of the hotel. A reception committee composed of the wives of the Boston hosts, welcomed the visitors and the balance of the evening was given over to dancing.

Thursday afternoon two inspection trips were arranged for the men, one party visiting the plant of the B. F. Sturtevant Company, at Hyde Park, and the other, the plant of the U. S. Cartridge Company, at Lowell, where an opportunity was offered to see the process followed in the manufacture of the Cartridge copper indirect air heaters.

At the same time automobile trips, planned especially for the ladies, included a drive to historic Concord and Lexington and one to Cambridge and Harvard University.

Other events for the ladies included bridge and theatre parties.

Over 300 members and guests attended the annual dinner of the society at the Copley-Plaza Hotel Thursday evening. Souvenirs for the ladies took the form of perfume bottles and leather cases, while the men were the recipient of razor-blade knives.

During the dinner the Meistersingers of Boston rendered several numbers and the diners were also entertained by a professional musician.

While the program provided for no formal addresses, Alfred Kellogg, acting as toastmaster, called upon the retiring president, Homer Addams, who felicitated the Boston hosts upon the success of the entire entertainment program. The new president, Samuel E. Dibble, was next called upon and the diners rose to him with a warm welcome.

President Dibble pledged himself to a year of work in the society's interest and then announced subscriptions totalling nearly $8000.00 which had been received that day towards the support of the society's Research Laboratory.

Dean Anderson was also given a standing welcome when he was called upon by Toastmaster Kellogg. Dean Anderson congratulated the society on its vision which prompted it to go forward with its research work and emphasized the importance of closer human relationships which are fostered

by such gatherings as the Boston meeting.

Toastmaster Kellogg, speaking for the officers and council of the society, paid a graceful tribute to President Homer Addams, and presented him with a diamond-studded watch fob bearing the insignia of the society.

Mr. Addams was manifestly taken completely by surprise, but soon found words to express his appreciation.

Following the speechmaking the floor was cleared for dancing which continued until midnight.

Serving with Chairman Kellogg on the general entertainment committee were: President William T. Jones of the Massachusetts Chapter, John S. Webb, R. E. Shaw, G. H. Gleason, J. F. Tuttle and Professor Arthur E. Norton.

The committee chairmen were: Finance, R. E. Shaw; hotel and dinner, J. F. Tuttle; excursion and social, Gilbert H. Gleason; registration and information, John S. Webb; transportation and publicity, William T. Jones; ladies committee, Mrs. Alfred Kellogg; committee on relations with other societies, Dr. Alice G. Bryant.

Past Presidents' Club Organized

The presence of no less than eight past presidents of the society led to the formation of a Past Presidents' Club. The organization meeting was held Wednesday night at the Copley-Plaza Hotel, and was described as a particularly happy occasion. Stewart A. Jellett of Philadelphia was made president and H. P. Gant, also of Philadelphia, secretary. Other past presidents who participated in the organization of the club are: Homer Addams, J. I. Lyle, H. M. Hart, J. R. McColl, F. R. Still and W. S. Timmis.

Death of Secretary Houghten's Father

A damper was cast over the opening session in Boston by the announcement that a telegram had been received by Secretary F. C. Houghten notifying him of the death of his father. Mr. Houghten, who was accompanied by Mrs. Houghten, left immediately for his father's home in Michigan. The sympathy of his many friends at the meeting was extended to Mr. Houghten in his bereavement.

Illinois Chapter Hears Talk on Boiler Ratings

Professor A. P. Kratz, research professor at the University of Illinois, was the principal speaker at the January meeting of the Illinois Chapter, which was held January 12, at the Engineers' Club, Chicago. His subject was "Low-Rate Combustion and Ratings." Under combustion, Professor Kratz discussed such points as fuel, depth of fuel, and air above, below and around the grates. It is customary, he stated, to rate boilers on grate capacity, and the factors of square feet of grate surface, combustion rate and coal value are known, but the joker of the usual formula is efficiency. All formulas, he stated, should take into consideration the factors of grate surface, heating surface and efficiency. Any attempt to combine these various factors into one is a mistake.

The final umpire on any rating, he said, are test data. He then showed a slide of test data and performance curves on a steam boiler and discussed such points as draft over fire, draft at smoke outlet, efficiency, height of chimney and capacity.

As an illustration of the irregularities resulting in the rating of a boiler under various installation conditions, Professor Kratz cited a boiler with a manufacturers' rating of 8500 sq. ft., with a combustion rate of from 8 to 11 lbs., installed where the chimney height was 20 ft. The rating given was insufficient due to the fact that different conditions prevailed than when the rating was fixed.

The University of Illinois, he stated, is urging that the proper method or formula for rating boilers should be in the form of a set of curves covering a complete range. Professor Kratz said that this may sound Utopian to the manufacturers and very costly, but that other manufacturers rate their products in this way and manufacturers of fans, electric generators and similar products are spending thousands of dollars to furnish better ratings and efficiency data.

Professor Kratz said a fixed relation should be made between flue temperature and fixed rates of combustion.

Another slide showed curves on warm-air furnace performance under test conditions, supplemented by a curve of register temperatures. Professor Kratz stated that the factor of heating surface had been neglected. Other slides gave the relation between heating surface and unit capacity and the relation between heating surface and capacity of furnaces. Professor Kratz expressed his belief that the same methods employed in the testing of furnaces may apply to boilers.

Among the points brought out in the ensuing discussion was that there is a great variance in the amount of direct and indirect heating surface in the different types of heating boilers manufactured and that until all boilers were built alike any given set of curves would be inadequate. Another point, brought up by Mr. Newport, was that when adding sections to a boiler and increasing its indirect heating surface, it would be impossible to get curves on the ratio of grate to heating surface.

The discussion then turned on the limits of fuel bed depths and Professor Kratz stated that the minimum depth for anthracite should be 13 to 17 in. With hard coal, he added, a 12-in. depth permits too much excess air to pass through the coal, also, with larger sizes of coal, deeper beds should be used.

During the business session the raising of funds for the continuation of the society's Research Laboratory was taken up. A suggestion made by C. W. Tomlinson, which was favorably received, provided for fellowships in the society to cover the Research Laboratory expense, the fellowships to be held by the older men in the society or bestowed on members by their employers. A resolution this effect, suggesting that the fellowship or "other methods" be followed, was put to a vote and adopted by the chapter.

It was announced that the principal speaker at the chapter's February meeting will be L. C. Soule, secretary of the Aerofin Corporation. The March meeting will be designated "stunt night" when troubles encountered and solved will be presented, with special reference to oil and gas-fired installations. Professor A. C. Willard, of the University of Illinois, is scheduled to address the chapter at its April meeting.

New Officers of Western New York Chapter

At the January meeting of the Western New York Chapter, at the Hotel Lafayette, Buffalo, the following officers were elected: William G. Fraser, president; Herman Worsham, first vice-president; Harry P. Dempsey, second vice-president; Calvin P. Wadley, treasurer and Roswell Farnham, secretary.

At the chapter's December meeting Section VI, of the proposed A. S. H. & V. E. code, covering "Minimum Capacity and Installation Requirements for Low-Pressure Steam and Hot Water Boilers," was discussed in detail.

Frank B. Howell presented the section for discussion, and among those who took an active part were Carl A. Sawade of Dunkirk, P. W. Schneider of Utica, Frank G. Phegley also of Utica, L. N. Danforth, C. A. Booth, and President Hutzel.

Philadelphia Chapter Installs Officers

The annual banquet meeting and entertainment session of the Philadelphia chapter was held at McCallisters, Philadelphia, January 8. Among the guests and speakers of the evening were: Homer Addams, president of the society; W. H. Driscoll, chairman of the Research Committee and a member of the council; J. I. Lyle, past president of the society, and John Cassell. R. C. Bolsinger opened the meeting and Thornton Lewis acted as toastmaster.

Officers elected for 1925 are: Robert P. Schoenijahn, president; Benjamin Adams, vice-president; Frank P. Lord, secretary, and James V. Cavileer, treasurer. R. C. Bolsinger, Charles F. Eveleth and Benjamin W. Wilson, compose the new board of directors.

A special committee, of which John F. Hale was one of the leading spirits, arranged the entertainment features which included a number of parodies on popular songs, with take-offs on heating and ventilation, together with a skit, written for the occasion by Mr. Hale.

Rating the Warm-Air Furnace

A Simplified, Approximate Method Based on Extensive Research Work and Adapted to Practical Use

By A. C. Willard

Professor of Heating and Ventilation and Head of Department of Mechanical Engineering, University of Illinois.

Presented at the Mid-Year Meeting of the National Warm-Air Heating and Ventilating Association, in Urbana, Ill., December 2-3, 1924

THERE is only one correct way to determine the rating of a warm-air furnace and that way is to test the furnace under the same conditions as will actually exist when it is installed in a house. This means that the same fuel, chimney, cold-air duct, casing, leader, stack and register system and air temperatures should be used in the test as in the actual installation. Such a proposal sounds almost absurd, as it is equivalent to saying that the rating of a furnace must be determined for each installation, since seldom are there two furnace heating jobs which are exactly alike.

Nevertheless, each and every one of the factors just named affects the rating of any given furnace, and for purposes of emphasis they are presented in amplified form in the following list:

(1) Fuel, which may be solid, liquid, or gas.

(2) Chimney and smoke connection, which determines draft available.

(3) Cold-air duct, which may have single or multiple connections, and supply either inside or outside air.

(4) Casing, which may be large or small in diameter, lined or unlined, and with a variety of bonnets.

(5) Leaders, stacks and registers, which may comprise a long or short system, running to first, second and third floor, or to only one floor.

(6) Temperature of the air entering cold-air face and leaving warm-air registers. This item also controls the rate at which fuel must be burned, and hence the draft required of the chimney.

Such items as insulation of casing, leaders and stacks are not included, since they can be made the same for all systems.

Realizing the truth of the statements in the preceding paragraphs, the National Warm Air Heating and Ventilating Association started out about five years ago to determine the importance and effect on the various factors just listed on the performance of a warm-air furnace when operating under practically actual installation conditions. Working under a co-operative agreement with the University of Illinois, the Furnace Research Staff of the Engineering Experiment Station of the University has secured and published data which make it possible to predict the effect of most of the given factors on the rating of warm-air furnaces. The results of the past five years of research work show that none of the six factors can be ingored when determining the rating of a furnace, although some factors are more important than others.

A TENTATIVE METHOD FOR RATING A GRAVITY WARM-AIR FURNACE

In response to many inquiries for an approximate method of computing the rating of a warm-air furnace, the following procedure has been outlined. This procedure is based on the results of the warm-air furnace research work to date as reported by the Engineering Experiment Station of the University of Illinois in Bulletins 112, 117, 120 and 141. Most of the necessary data will be found in the latter bulletin.

Attention is especially directed to the comments on the six factors affecting furnace rating as they existed in the testing plant.

(1) Fuel was stove size anthracite coal of 12,790 B.T.U. heat value per pound as fired.

(2) Chimney was 12 in. diameter and 35 ft. high and was ample to create the draft necessary to burn 7.5 lbs. coal per square foot of grate per hour. As a matter of fact, on some tests, this chimney did burn over 13 lbs. of coal per square foot of grate per hour.

(3) Cold-air duct was of the recirculating type with large flat shoe and a single register at first floor level.

(4) Casing was of best diameter for each furnace tested, with a black-iron liner and 1 in. air space. The bonnet was conical.

(5) Leaders, stacks and registers supplied air to *three* floor levels.

(6) Temperature of air entering cold air duct was reduced to 65° F. and air leaving registers was at an average temperature of 175° F.

RATINGS GIVEN IN SQUARE INCHES OF LEADER PIPE AREA.

The present practice of rating furnaces in square inches of leader pipe area is as practical as any method so far devised and will be followed in this discussion.

Probably the most important of the six factors affecting the rating of a given furnace is the air temperature at the registers, and this must be agreed on in advance before any discussion of ratings can be undertaken. We have suggested above, in item 6, that the air temperature be approximately 175° F. at the registers when the furnace is operating at maximum capacity. By actual test, we have found that the combustion rate required to maintain an average temperature of 175° F. at the registers is about 7.5 lbs. of good coal per square foot of grate per hour.

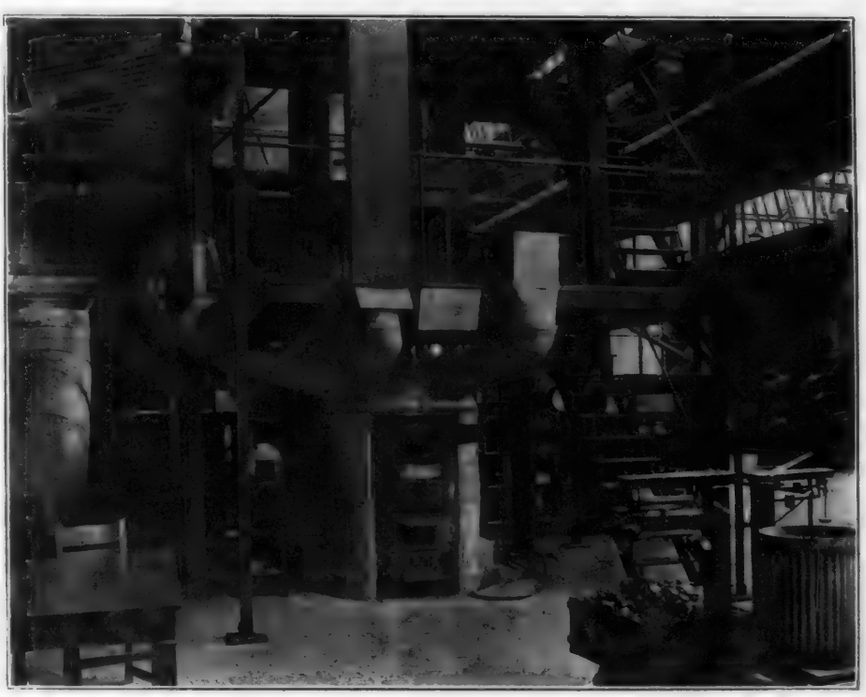


Fig. 1.—Furnace Test Plant at University of Illinois Engineering Experiment Station

Such coal should have a heat value of at least 12,000 B.T.U. per pound. Coal used in our tests runs 12,790 B.T.U. per pound as fired.

Hence, the rating of a furnace such as those which we have tested in our laboratory can be roughly expressed as follows:

$$\text{Heat available in B.T.U. per hour at the Furnace bonnet} = H_b = G \times C \times F \times E \quad (1)$$

In which,

G=grate area, square feet.

C=Combustion rate, pounds coal burned per square foot of grate per hour, which depends on register temperature desired, and for 175° is approximately 7.5 pounds.

F=calorific value of fuel, B.T.U. per pound as fired.

E=efficiency of heater, or ratio of heat available at bonnet to heat available in fuel.

Since it is not possible to transmit all of this heat to the registers, due to leader and stack losses, and we can expect to get only about 75% of the above heat delivered into the rooms of the house, we have as a general expression for heat available at registers:

$$\text{Heat available in B.T.U. per hour at the } \textit{registers} = H_r \quad \text{or} \quad H_r = 0.75 \times H_b \quad (2)$$

Note that the figure 0.75 is suggested as an average value only. In the test plant, the actual value when burning coal at a 7.5-lb. combustion rate was 0.722, instead of 0.75.

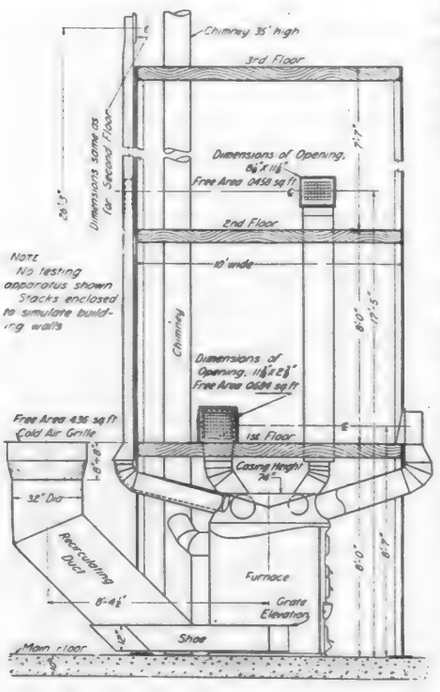


Fig. 2.—Sectional Elevation of Piped Furnace Test Plant

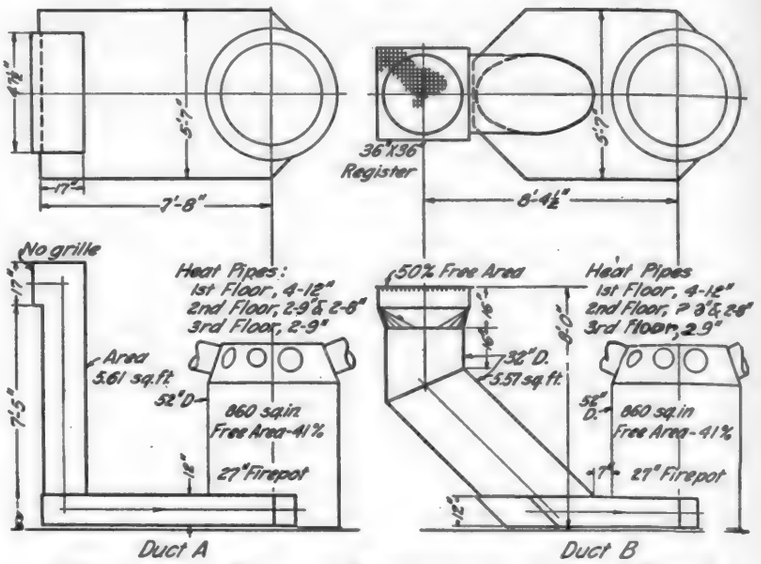


Fig. 3.—Two Types of Re-circulated Air Duct Tested

THE RATING FORMULA, GIVING CAPACITY IN SQUARE INCHES OF LEADER PIPE.

The average heat carrying capacity per square inch of leader pipe to first and second floor is about 136 B.T.U. per hour at a register temperature of 175° F. Hence the rating of a furnace in square inches of leader pipe would be:

$$\text{Rating in square inches of leader pipe} = \frac{H_r}{136} = \frac{0.75\,(G \times C \times F \times E)}{136} \quad (3)$$

It should be noted that the value 136 will not hold for a bungalow installation where *all* registers are on first floor. In such a case use 106, and in the case of *all* registers on second floor, use 166. The value 136 applies only when there are approximately equal heating loads on the first and second floors.

APPLICATION OF THE FORMULA TO AN ACTUAL FURNACE

The preceding discussion is based upon tests of an actual furnace having a grate area of 2.88 sq. ft. and a heating surface above the grate of 58.9 sq. ft. Applying the equation just derived to this furnace when burning coal at the rate of 7.5 lbs. per square foot of grate, then using the same coal as fired in the tests with a heat value of 12,790 B.T.U. per pound, we get:

$$\text{Rating in square inches of leader pipe} = \frac{0.722\,(2.88 \times 7.5 \times 12{,}790 \times 0.55)}{136} = 808. \quad (4)$$

METHOD OF ALLOWING FOR HEATING SURFACE IN THE RATING OF A WARM-AIR FURNACE

Again note that the exact value for this plant of 0.722 is used instead of the suggested average value of 0.75 as shown in equation (3).

Another furnace with a grate area of 2.74 sq. ft. and a heating surface above the grate of 67.8 sq. ft. gave, when tested, a capacity somewhat greater than the first when burning coal at the same rate per square foot of grate, showing that the ratio of heating to grate surface must be taken into account by any rating formula.

The heating surface to grate surface ratio for the first furnace was $\frac{58.9}{2.88}$ = 20.5, and for the second furnace was $\frac{67.8}{2.47}$ = 27.5, and the heat available at the bonnet per square foot of grate was 53,000 B.T.U. and 61,000 B.T.U. per hour respectively. In checking up these heating surface areas from Bulletin No. 141, you will find the total area of the first furnace listed as 70.3 sq. ft., of which 11.4 is ash-pit surface. The second furnace is listed as 78.4 sq. ft., of which 10.6 is ash-pit surface. Since the American Society of Heating and Ventilating Engineers has defined heating surface as surface above the grate, we have deducted the ash-pit surface in each case, although the writer believes such surface to be quite effective with combustion rates of 7.5 lbs. and above. Hence, for equal grate areas there was an increase of 61,000 — 53,000 = 8,000 B.T.U. in bonnet capacity, and the heating surface to grate surface ratio increased 27.5 — 20.5 = 7 units, or an increase of 1140 B.T.U. per unit of the ratio of heating surface to grate surface above a ratio of 20.5.

It would, therefore, appear that each unit increase in the heating surface to grate surface ratio has added $\frac{1140}{53{,}000} \times$

100 = 2.15% to the bonnet capacity. It must be expressly understood that this gain in capacity of 2.15% per unit increase in the heating surface to grate surface ratio does not continue indefinitely. Later tests on furnaces with high ratios will determine this point, but for the present it will probably be safe to assume that the gain in capacity does not fall off appreciably for heating surface to grate surface ratios below 30 to 1.

We may apply this correction to our rating equation (3) by using the even values 20 for base ratio and 2 for per cent gain, and allow for the effect of heating surface by multiplying the normal rating value as obtained in equation (3) by $1+(R-20)\times 0.02$, where R=ratio heating surface to grate surface. There would, of course, be no allowance made for furnaces in which $R = 20$, since, $1+(20-20)\times 0.02 = 1+0 = 1$, and multiplying by 1 has no effect. Also note that if R is less than 20, the value is less than 1, and such a furnace would be penalized for deficient heating surface.

To illustrate the effect of this correction, suppose we now compute the rating of the furnace which has a heating surface of 67.8 sq. ft. and a grate area of 2.47 sq. ft., or a heating surface to grate surface ratio of 27.5. By equation (3), using 0.722 instead of 0.75 we have,

$$\left.\begin{array}{l}\text{Square inches of leader}\\ \text{pipe supplied}\end{array}\right\} = 0.722\ \frac{(G\times C\times F\times E)}{136}$$

$$= 0.722\ \frac{(2.47\times 7.5\times 12{,}790\times 0.55)}{136} = 691.$$

But this furnace has a heating surface grate surface ratio of 27, for which an allowance should be made by multiplying by the following factor:

$1 + (27 - 20) \times 0.02 = 1 + 7 \times 0.02 = 1.14.$

so that the final rating becomes

$691 \times 1.14 = 788$ sq. in. of leader pipe.

For general use, a single equation (5) can be used making it possible to include the factor for heating surface to grate surface ratio in equation (3) and express the final rating of a furnace in square inch of leader pipe as:

$$0.75\ \frac{(G\times C\times F\times E)}{136}\times [1+(R-20)\times 0.2] \qquad (5)$$

where R = ratio heating surface to grate surface.

It must be remembered that the values used in the preceding discussion are based on tests of a very carefully designed plant, and later tests in the new Warm-Air Heating Research Residence on other types and sizes of furnaces may lead us to change some of the values slightly.

For commercial ratings, the manufacturer should certainly allow some factor of safety to account for actual installation conditions where usually some conditions are not entirely satisfactory. That is, ratings as determined by formulas 3, 4, or 5 should probably be reduced somewhat before they are published in commercial catalogs.

Between the Lines

WOULD it not be an act of grace to broadcast a word or two in soft protest against the indiscriminate use of that word "Engineer." An engineer, rightly speaking, is one who has the training, ability, aptitude and vision to discover, co-ordinate and administer the materials and forces of Nature to the end that Man may continue to be less a subject and more of a master of his material surroundings. If the present acceleration of candidates continues we will shortly have tonsorial engineers, lawn-and-garden engineers, safe-cracking engineers and a host of just plain engineers who will volunteer, for a small consideration, to tell us how to do anything. Let us use and apply the word "Engineer" rightly or let it slip from our mind.

It is at times almost hopelessly discouraging to attempt to fathom the mental attitude toward life of some of our young men—and in that class may be included all those this side of seventy or thereabouts—who apply for positions (it's a job if they're broke) with contracting and industrial organizations. Their whole conscious and subconscious view point and query seems to be: "What is there in it for me?" Give a lecture or a heart-to-talk to these same young men on how to make themselves more valuable to their employers and, as a corollary, to themselves, and you will still hear that same old war-cry, "What is there in it for me?" Well, a good answer is to say, "That is just what the safe-breaker asks before he pours the last ounce of nitro-glycerine into the plugged cracks of the safe door." There is nothing in life or a job to be gotten except what you put into it. And the more you put, the more you take. This all sounds fundamental—not to say trite—but some men don't know the ABC's of Life and its compensations. They are still confounding success and luck.

Why isn't it possible for the industry to put a little more idealism into its work-a-day world and a bit less of ice-bound commercialism. Perhaps there is the same old cry of "What is there in it for me?" though a step up the commercial ladder. All business is a means to an end—if we could only carry some of the idealism and spirituality we absorb outside our business into its human contacts and relations, both the means and the ends would be increased an hundred fold.

There is a firm not many miles from New York which puts idealism into its business in large measure. They think it, talk it, act it. They started in a basement or a stable or a garage a short thirteen or fourteen years ago, but last year they did almost a million dollars' worth of business in heating, ventilating and sprinkler work. They idealized their business. They won not only the material rewards which come from any work well done, but they have time and take it to delve into and enjoy the finer things of life, such as Art, Literature and Music. They live a full and complete life in every sense of the word and they are a source of inspiration to those with whom they come in contact. Did they ask "What is there in it for us?" Absolutely, No. They are getting out of life exactly what they have put into it—and a large portion left over for the other fellow.

It is possible to imagine an employer of skilled or semi-skilled help asking for references. It possibly is the best thing to do if the aforesaid help is to handle funds in greater excess than his weekly pay. If so, have him bonded. But the average artisan, artist, genius, hero or whatnot should have about as much use for such extraneous matter as a pig has for a vest pocket. Yet they are demanded; though their value is on a par with a plugged Confederate dime. They are all so easy to get and so hard to live up to. Why not ask them if they know their business; you can tell in twenty-four hours whether they do or not. Many a man without these seemingly all-important papers may become the One Bright Star in your business constellation if you will give him a chance to prove himself. A volume could, yea, has been written on this subject. Yet we hire the mediocre with references a mile long, while the genius without a scrap of commendation walks the streets.

Death of Edgar C. Molby

Edgar C. Molby, for many years a prominent figure in the house-heating boiler industry as president of the Molby Boiler Co., manufacturer of the Molby magazine-feed boiler, died January 29, at his home in Forest Hills, Long Island. A more extended account of Mr. Molby's career will appear in next month's issue.

Central and District Heating Possibilities in Canada

A NOTABLE survey of central and district heating in Canada and the United States, as well as abroad, together with an estimate of the future possibilities of district heating, with special reference to Canada, is contained in the recently-published report to the Dominion Fuel Board, in co-operation with the Department of Mines, by F. A. Combe, consulting engineer, who was appointed last year by the Fuel Board to make this investigation.

Probably the most important conclusion reached by Mr. Combe and one which is endorsed by the Dominion Fuel Board is that "central and district heating can be profitably employed to a considerable extent in Canada, and the supply of heat as a public utility in the denser sections of cities and towns may be looked for as a general service of the future."

Other conclusions reached by Mr. Combe are:

2. Central heating of groups of institutional buildings and community heating of residential properties have shown the economies and benefits to be derived, and such systems undoubtedly will be adopted to an increasing extent.

3. In the United States, district heating has now passed through the development period, and although financial failures and difficulties have been experienced in the past, as in the early stages of any other utility, the knowledge gained and advances made during recent years in design, construction, and method of operation assure the success of undertakings in suitable districts under proper conditions of application, correct engineering, protective rates, and efficient management.

4. In many parts of Canada, conditions are particularly favorable to district heating: climate; high differential between the prices of coals commonly used for domestic heating and cost of low-grade fuels; and possible combination with electric power supply, both from steam and hydro plants.

5. Application of methods of centralized heating and steam service will assist in the solution of the fuel problem in the provinces of Ontario and Quebec by making possible a reduction in high-priced coal importation from the United States and the greater utilization of Canada's own resources.

In the course of his investigations Mr. Combe visited and studied the operation of fifteen representative heating utilities in the United States and ten district and central heating systems in Canada. Additional information was secured regarding the operation of district heating systems in Europe.

As stated in the report, the tendency in recent years, especially on this continent, has been towards centralization of heating plants, the heat being distributed through pipes by the medium of steam or hot water to serve groups of buildings; or, as a public utility, entire sections of the cities.

Speaking of the present wasteful methods of independent production of different forms of energy, the opinion is expressed that these could be largely overcome by a properly-balanced grouping, and the trend of future progress seems to be towards a combination of electric generation and the supply of steam for both power and heating to an entire district from one central plant.

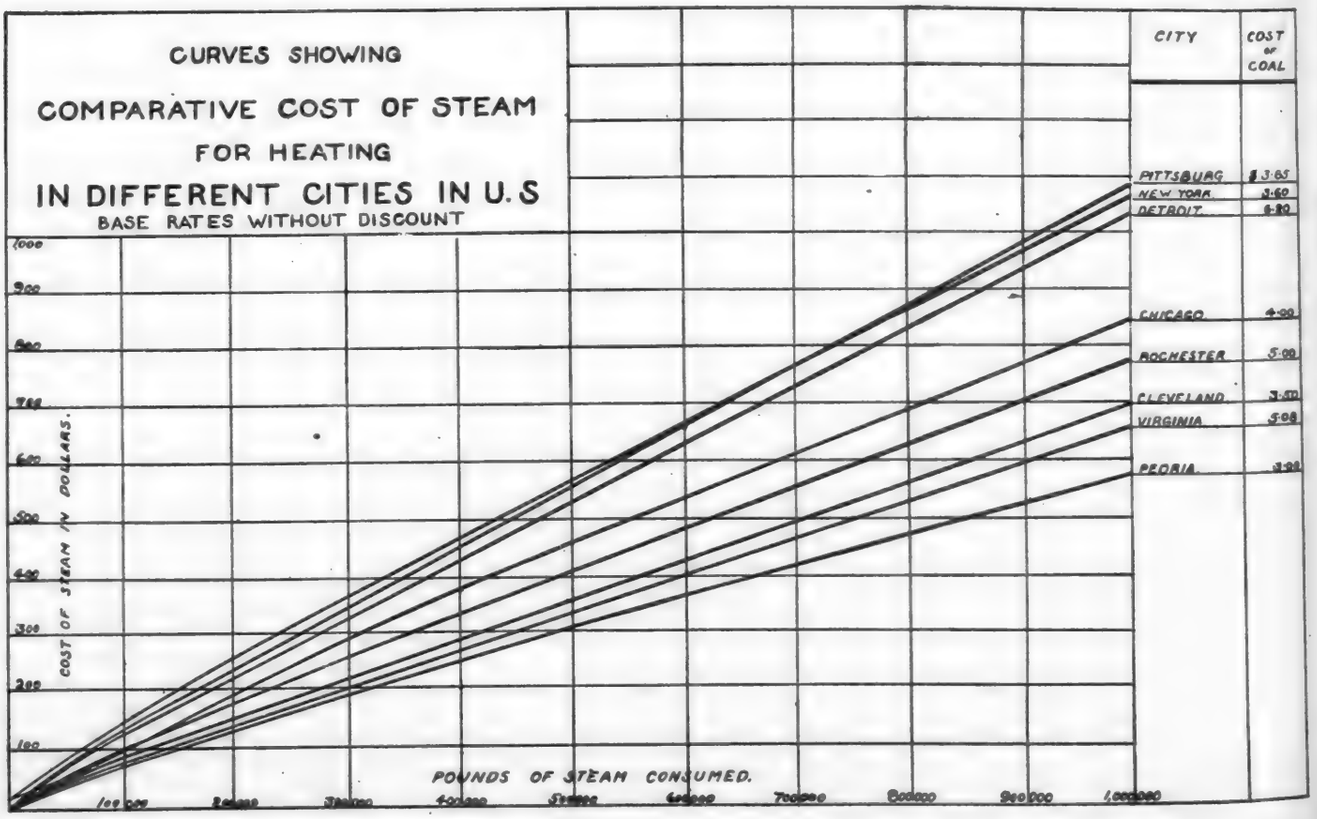
The report discusses centralized heating under these classifications:

1. *Central Heating*—as applying to the distribuiton of heat by means of steam or hot water through a system of underground piping from a central boiler plant to a number of buildings comprising a school, university, hospital, asylum, or other institution which is included under one management.

2. *District Heating*—as applying to a public utility or independent company furnishing steam or hot water to buildings in a city or town, the heat being purchased in the same manner as electricity, water, or gas.

3. *Community Heating*—as applying to a block or group of dwellings heated from a central plant, either by private arrangement between the owners, or as a development by a company, selling or renting dwellings under special agreement for heating.

Under the heading of "Central and District Heating in Other Countries" the report reviews the situation to date in Europe, mentioning particularly the system in Vienna, described as the largest central heating installation in Europe, which supplies some 60 buildings of an asylum, with an aggregate volume of over 26,000,000 cu. ft. Another plant referred to is the Poststrasse Station in Hamburg, which supplies heat to 141 office buildings using 28,000 lbs. of steam per hour. By com-



bination with another system it is proposed to extend this system in the near future to 200,000 lbs. of steam hourly.

INSTALLATIONS IN CANADA

Central heating has been adopted in Canada to a considerable extent for groups of institutional buildings, and, with the realization of the economy and convenience to be secured, many of the older installations of independent furnaces are being replaced by such systems. Regulation of the heat from one central point; the possibility of burning a cheaper grade of fuel in large, specially designed furnaces; and the elimination of labor and extra expense of operating a number of small heating furnaces make central heating well suited for such a class of buildings.

As representative of the larger central heating installations are mentioned:

	Cubic feet
University of Toronto, Toronto, comprising 27 buildings, aggregating approx.	29,000,000
Parliament Buildings, Ottowa, comprising 7 buildings, aggregating approx.	16,000,000
McGill University, Montreal, comprising 9 buildings, aggregating approx.	7,000,000
Alberta University, comprising 18 buildings, aggregating approx.	7,000,000
Queens University and Kingston Hospital, comprising 22 buildings, aggregating approx.	5,000,000

CONDITIONS IN UNITED STATES AND CANADA COMPARED

There is a marked similarity, states the report, in the mode of living, habits, and progress of the peoples in Canada and the northern United States, and the extent to which district heating may profitably be employed in Canada can be gauged by a study of conditions prevailing in the two countries. A detailed examination has been made of fifteen representative district heating systems in the northern United States, in addition to two in Canada, to determine the factors governing their operation; and a general survey has been made of the existing conditions in different parts of Canada.

HEATING REQUIREMENTS

From a considerable number of figures obtained it appears that contrary to what might be thought to be the case the coal consumption for heating dwellings and other buildings in Canada is not appreciably more than in the northern United States, in fact is, in general, slightly less, in spite of the difference in temperature.

It is suggested that the seeming relatively lower coal consumption in Canada, compared with the United States, may be due in part to:

(*a*) The buildings in Canada being constructed to better withstand the cold, with general use of double windows, etc.

(*b*) Lower indoor temperatures being customary.

(*c*) Artificial heat being maintained in many cases for a longer period in the United States than in Canada.

(*d*) The greater use of hot water radiation in dwellings in Canada.

It will be seen from the map that Canada is handicapped in the full use of her own coal by the long freight hauls from point of mining to point of greatest consumption, and hence, although possessing vast coal resources, is not commercially self-supporting in this commodity.

POSSIBLE EXTENT OF DISTRICT HEATING IN CANADA

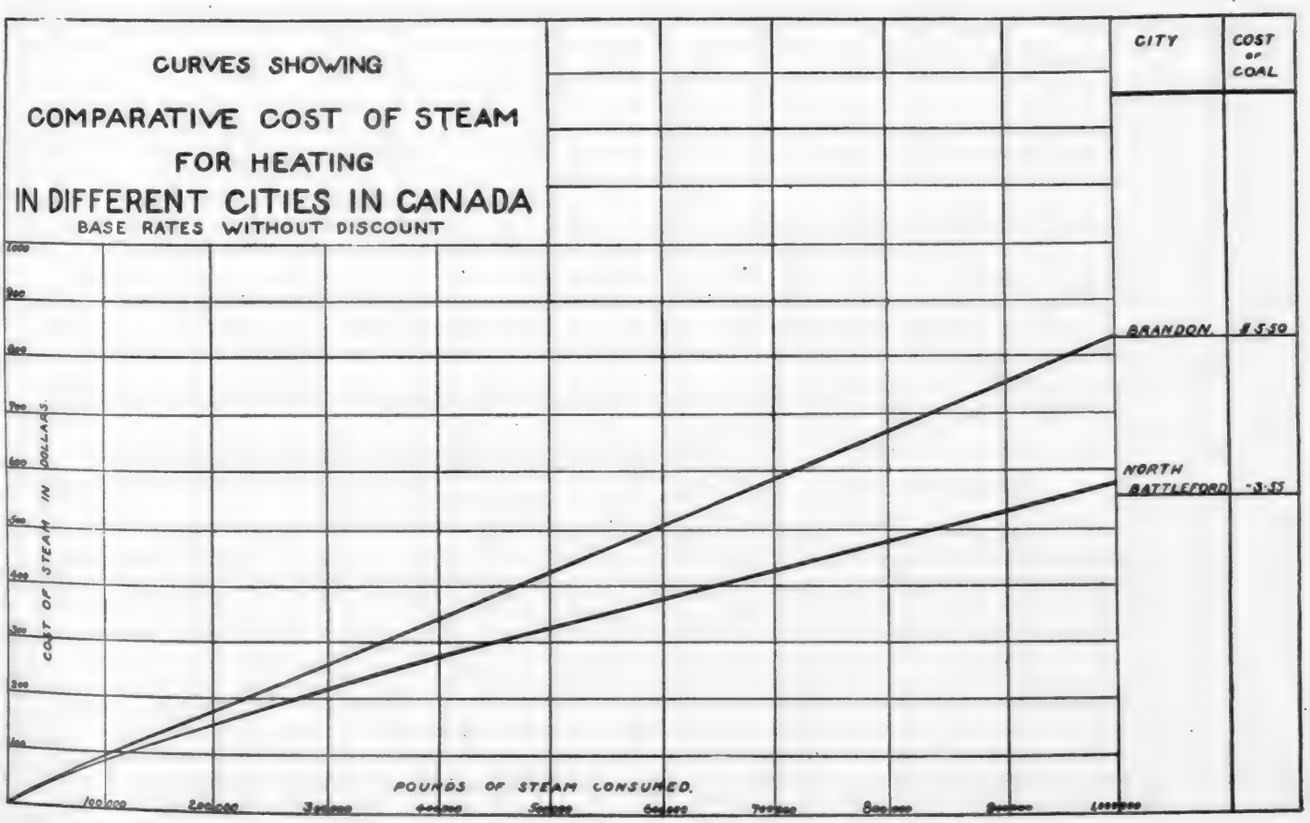
According to the last Dominion census, 1921, approximately 46% of the total population in Canada, or 4,021,756 persons, reside in urban centers of 4,000 population and over. Of these:

569,609 are included in 99 municipalities of 4,000 to 10,000 population.

818,892 are included in 46 municipalities of 10,000 to 50,000 population.

2,633,255 are included in 13 municipalities of 50,000 and over.

A town of 4,000 population can be taken as the low limit in which district heating could be considered, and in actual practice, conditions would have to be somewhat special for an economic undertaking of district heating in any town under 10,000 population, such as a possible combination with a favorably situated municipal steam electric station or industrial plant, or a particularly progressive community willing to bear an increased cost of heating for the convenience and benefits to be derived therefrom. North Battleford is an example of the former case, where with a population of only 4,000, district heating as a municipal enterprise in connection with the steam electric



station has proved satisfactory. In the United States several instances of successful small-town heating can be cited.

The principal field for district heating is found in the larger towns and cities, particularly in the business and shopping sections where the heating and steam load is greater and more concentrated. Whether, or to what extent, district heating may be profitably or commercially applied in any particular district depends upon local conditions: definite limitations cannot be drawn, but the main factors to be taken into consideration are discussed in some detail in the report.

INFLUENCE OF STEAM-ELECTRIC AND HYDRO-ELECTRIC UTILITIES ON DISTRICT HEATING

In the United States, the report continues, district heating in its early application was developed largely in connection with the generation of electricity from steam, primarily to use the exhaust steam, but, also, by supplying heat as well as electricity to induce the abandonment of privately owned plants. Where the steam electric stations were situated within the city limits and convenient to the heating areas this could well be done, but with the increased use of electric power these stations have been replaced by larger ones situated at strategical points to serve not only one city but distribution power systems over wide sections of the country.

As a consequence, in the large cities, district heating is now supplied either from independent boiler plants or from auxiliary steam plants that generate electric current as a by-product to the extent of the heating steam demand, and feed into the main electric power system. Local conditions govern the choice of plan.

Where additional steam is required for an increasing district heating service, the cost of installation and operation of auxiliary steam electric generators may not be justified by the saving made over the cost of generating electricity at the main station. Also, if it is necessary to transmit steam for a considerable distance to feed the district heating area, small, high-pressure pipe-lines may prove more economical than the necessarily large distribution pipes needed for exhaust steam from auxiliary steam electric units.

HYDRO STAND-BY COMBINATION

Illustrative of the former is the municipal district heating system projected for Winnipeg in connection with the hydro-electric system and other municipal services. This undertaking involves the installation of a 15,000 H.P. steam station to:

(*a*) Serve as a reserve to the hydro-electric system.

(*b*) Furnish steam for district heating in the down-town section of the city to the full capacity of the plant, with the utilization of off-peak power from the hydro-system for the generation of steam.

(*c*) Supply power in connection with the municipal fire-pumping and water-works systems.

The daily load curve of a hydro-electric service states the report, is in many cases such that there is a considerable amount of waterpower available and unused during certain periods of the day, and the use of this power for the production of steam by electric steam generators provides a means to increase the load factor on the hydro plant and to save fuel in the steam station. Provided that this "dump" power can be supplied or shut off at short notice, it can be sold at a very low rate to outside consumers, and an independent hydro-electric company in Winnipeg, is at the present time supplying current on such terms for the heating of a large block of buildings in the business section, showing an appreciable saving in fuel to the heating company and a profitable use of waterpower which would, otherwise, be wasted.

There are similar opportunities for such applications in other cities and towns.

CAUSES OF FAILURES

To say that district heating has been a profitable business wherever it has been adopted in the United States would be untrue. As the report admits, there have been many failures in the past, as in the early stages of any utility, but in every case the failures have been due to one or more of the following causes:

Unsuitable territory in respect to density of load.

Poor design and installation.

Bad management or inefficient operation.

Failure to maintain system in proper condition permitting excessive deterioration and depreciation.

Inadequate rates.

Residential Districts. Many competent engineers claim that district heating in residential sections can seldom be made profitable, because the steam demand is too small compared with the length of distributing pipe. On the other hand, there are many instances of district heating in towns, including residential districts, which have proved very successful commercially. It is impossible to make any general statements as to the amount of connected load that will warrant the installation of a central plant. A great deal depends upon the relative cost of the fuel burned in a central plant and that normally used for independent furnace heating; but with the differential which commonly exists it has been generally established that, to give reasonable return to the heating company, a rate for heating dwellings must exceed the cost of fuel for individual heating, although this excess may be balanced by the cost of furnace attendance and the benefits to be derived from such service.

The class of residents and the sentiment of the community have a considerable bearing upon the possible commercial success of heating residential districts, through the willingness of the consumer to pay an increased price for added comfort and convenience. In the case of municipally owned heating plants, especially if operated in conjunction with electric light stations or other public utility, the same return on the business is not required as for a commercial enterprise and in several cases, as for instance in the city of North Battleford and the town of Virginia, the cost of district heating has been actually less than the cost of fuel, even for private dwellings.

It should be expected for the success of any projected undertaking that the particular conditions be analysed by an engineer experienced in this branch of work, and familar with Canadian conditions, to determine whether a certain territory can be profitably served with district heating. It is essential, also, that the details of the system be laid out by an engineer in touch with modern practice and design.

In connection with the accompanying figures showing the charge for steam for heating in ten cities in the United States and for three operating systems in Canada, the average cost of fuel used by the heating companies in 1923, is given. In the example taken the rates in general follow the cost of fuel except in the very large cities where it might be expected that the high costs of installation and distribution have a particular influence.

The tendency in the large United States cities, the report shows, is towards independent district heating and steam service, with the possible use of auxiliary back-pressure turbo-generators, and the trend of modern practice appears to be towards the use of high velocity feeders from one or more strategically situated central plants to tap into the "gridiron" distribution system at different points. By such an arrangement steam is supplied at high pressure from the station, and a considerable pressure drop allowed through the feeders. In Detroit, steam velocities up to 75,000 ft. a minute have been measured in the feeders. This results in a reduction in transmission loss from radiation and condensation and as a rule in lower cost of installation, although as regards the latter, the smaller high-pressure pipe-line is offset by the better construction and conduit required.

Block heating, states the report, has many advantages. The operating company needs no franchise or permits to tear up and repave streets, and the initial cost and upkeep are small. On the other hand, with plants in the sub-basements, as a rule in restricted space, the efficiency of steam generation will not be so high as in a large central station, and the cost of coal and ash handling, and operating will be considerably higher.

COMPARISON OF STEAM AND HOT WATER

The main advantages and disadvantages of steam and hot water for central or district heating are summarized as follows:

Steam—Accurately and easily metered.

Flexibility for various uses apart from heating.

Increased capacity of mains possible by high steam pressures.

Lower installation cost than for hot water.

Hot water—Must charge on flat rate basis as not easy to meter heat consumption.

Improved efficiency with less transmission loss.

Limited for supply of high buildings by pressure on system.

The author also goes into detail on factors governing the commercial success of district heating; distribution systems; meter and service connections. He describes intimately many of the big plants in the United States, such as those of the New York Steam Corporation, Detroit Edison Company, and others; also plants now operating in Canada, such as those of the Winnipeg Service Company, Dominion Government and other.

The report concludes with an exhaustive bibliography on district heating from 1914 to 1923, no less than 48 of these titles being those of special articles and reports published in THE HEATING AND VENTILATING MAGAZINE.

Takes Issue with Statements on Warm Air Furnace Operation

Criticisms of the warm-air furnace method of house-heating must run the gauntlet of expert criticism, these days, if they are to "get by." The warm-air furnace manufacturers, in the light of their research work at the University of Illinois and with their Heating Research Residence at Urbana ready for business, are evidently out to see that full justice is done to the much-abused heating furnace.

An article, for instance, in THE HEATING AND VENTILATING MAGAZINE for November, 1924, by Samuel S. Wyer, associate in mineral technology at the U. S. Smithsonian Institution, in a series on "How to Heat Your Home," contained reflections on the warm-air furnace method of heating which have brought forth a sharp rebuttal from Professor A. C. Willard, professor of heating and ventilation at the University of Illinois and in charge of the furnace heating research work there.

Commenting in detail on the article in question, Professor Willard states:

"Both Professors Kratz and Day, as well as myself, have gone over the article by Samuel S. Wyer on "How to Heat Your Home" as printed on page 80 in the November issue of THE HEATING AND VENTILATING MAGAZINE. The article contains certain recommendations and statements which are decidedly contrary to what is considered as good practice today in the heating of homes by warm-air furnaces. Moreover, the reader is left with the impression that the warm-air furnace, (1) is inherently defective in maintaining a proper percentage of relative humidity in the home, (2) should take its air supply from the basement, and (3) must be equipped with a fan to operate properly and provide satisfactory circulation. We take exception to these statements as being positively misleading, and therefore detrimental to the warm-air furnace system of heating.

"Our detailed comments on these three items follow:

"'In most houses, especially when warm-air furnaces are used, the room air is too dry for health and comfort.'

"The warm-air furnace system is the only home heating system which provides a positive means for humidifying the entire house directly and easily from the heater in the basement. Not only do steam and hot-water plants fail to make any provision for humidifying the home, but it is very difficult to find humidifying devices which may be adapted to such plants. With a hot-water system, it is practically impossible to humidify a home except at considerable extra expense. The statement in the article gives exactly the opposite impression.

"'With proper humidity of air, not less than 30% lower temperatures may be comfortably maintained and less fuel used.'

"If this statement is intended seriously, the occupants of such a home would have to wear overcoats, as a simple calculation will show. Assuming the home is without proper humidity, and hence requires an air temperature of 75° F. Then, according to the article, with proper humidity not less than 30% lower temperatures may be maintained, or $75° \times 0.70 = 52.5°$ F. is recommended. Civilized people can't live in a place kept at 52.5° F. regardless of the humidity in such a place. The statement is absurd.

"'Most warm-air furnaces take their cold air only from the outside. This is wrong. When the basement is clean, by merely taking the air out of the basement * * * '

"It is contrary to all laws of sanitation, cleanliness and good furnace practice to take air from any basement. Dirt, soot and ashes, resulting from the handling of coal and ashes, will soon pollute the whole house, to say nothing of basement odors. Moreover, basement doors must be left open to secure anything like an adequate circulation.

"'Warm-air furnaces have been installed on this plan for many years * * * '

"The furnace manufacturers positively condemn such a scheme, and it will only be found in the cheapest class of installations where there was no supervision. The writer of the article seems to be entirely unaware of the proper method of accomplishing recirculation of air in a furnace heating system by taking the air from the first floor through a simple system of recirculating ducts and registers. All modern systems are installed in this way, securing the equivalent saving in fuel in a sanitary and positive manner.

"'Most warm-air furnaces have a sluggish warm-air draft, depending on the wind, on some days or to some rooms of the house.'

"This paragraph gives the impression that a fan of some sort is essential to a satisfactory warm-air furnace heating system. Any experienced furnace man can design and install a gravity circulating warm-air furnace system for a home which will operate successfully without a fan. If a fan is used, it must be of ample size, and it will not be effective unless the system was well designed in the first place. In a poorly designed system, the fan may prove of little value in correcting the defects, unless it is a very powerful fan. The fan merely accelerates the flow to the better circulating part of the system, and often adds but little to the poorer circulating portion of the system."

Your Income Tax

The exemptions under the revenue act of 1924 are $1,000 for single persons and $2,500 for married persons living together, and heads of families. In addition a $400 credit is allowed for each person dependent upon and receiving his chief support from the taxpayer, if such person is under 18 years of age or incapable of self-support because mentally or physically defective.

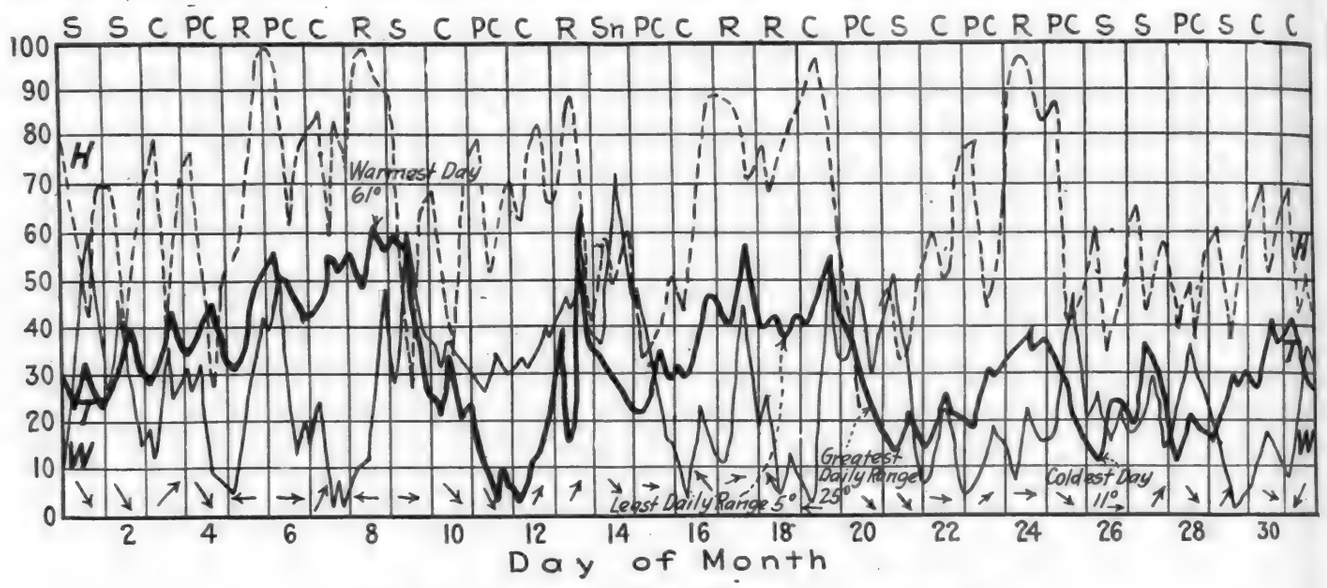
The normal tax rate under the revenue act of 1924 is 2% on the first $4,000 of net income in excess of the personal exemptions, credit for dependents, etc., 4% on the next $4,000, and 6% on the balance. Under the preceding act the normal tax rate was 4% on the first $4,000 of net income above the exemptions and credits, and 8% on the remaining net income.

The revenue act of 1924 contains a special provision for reduced taxes which did not appear in previous laws. All net income up to $5,000 is considered "earned income." On this amount the taxpayer is entitled to a credit of 25% of the amount of the tax.

For example, a taxpayer, single and without dependents, may have received in 1924 a salary of $2,000 and from a real estate transaction a profit of $3,000. His total net income was $5,000. Without the benefit of the 25% reduction his tax would be $80. His actual tax is $60. From his net income of $5,000 he is allowed a personal exemption of $1,000; the tax of 2% on the first $4,000 is $80, one-fourth of which, or $20, may be deducted.

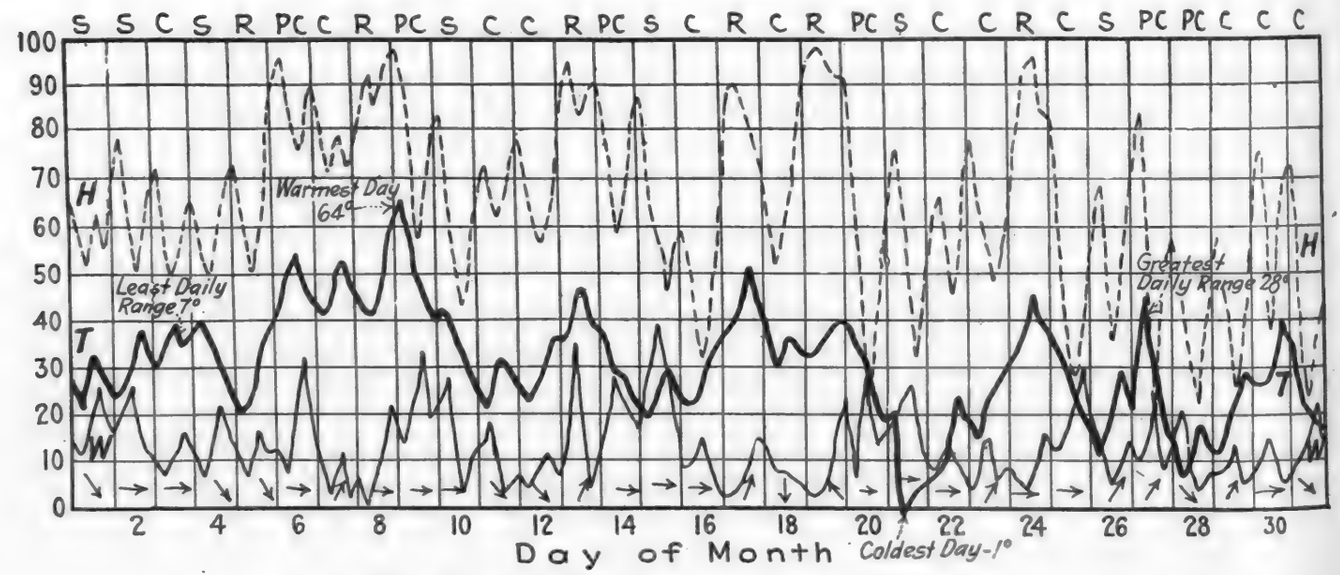
The Weather For December, 1924

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	61	64	64	56	69
Date of highest temperature	8	9	17	8	6
Lowest temperature, deg. F.	11	–1	0	–13	–8
Date of lowest temperature	26	21	28	28	28
Greatest daily range, deg. F.	25	28	31	33	32
Date of greatest daily range	20	27	19	8	16
Least daily range, deg. F.	5	7	4	4	6
Date of least daily range	18	3	21	4	30
Mean temp. for month, dep. F.	34	31.1	31.4	23.4	30
Normal mean temp. for month, deg. F.	35	32.5	34.2	30	34.8
Total precipitation, in.	2.38	1.48	1.95	1.9	4.63
Total snowfall, in.	0.9	0.2	3.4	3.3	2.1
Normal precipitation, this month, in.	3.45	3.41	2.73	2.07	2.23
Total wind movement for month, miles	14694	8480	9554	9511	9733
Average wind velocity, miles per hour	19.8	11.4	12.8	12.8	13.1
Prevailing direction of wind	N. W.	W.	S. W.	W.	S.
Number of clear days	5	7	3	8	10
Number of partly cloudy days	10	11	2	11	5
Number of cloudy days	16	13	26	12	16
Number of days with precipitation	7	5	13	12	7
Number of days with snow	3	1	5	5	3
Snow on ground at end of month, in.	None	None	1	0.8	0.8

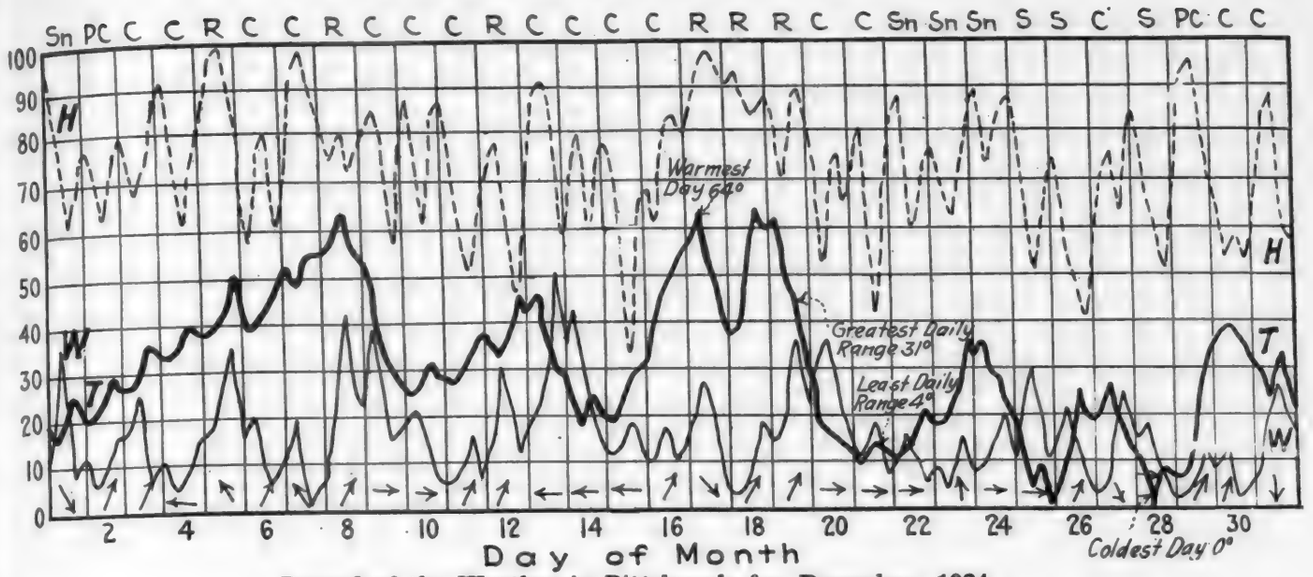


Record of the Weather in New York for December, 1924

(Hourly Observations of the Relative Humidity Plotted on This Chart)



Record of the Weather in Boston for December, 1924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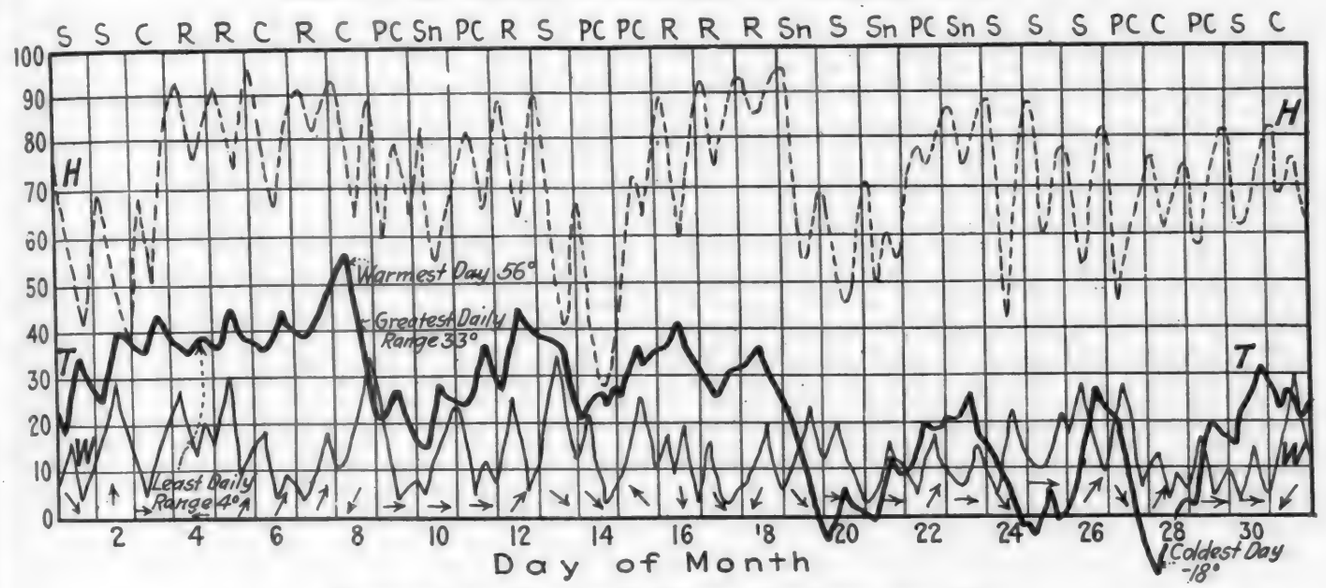
Warmest Day 64°
Greatest Daily Range 31°
Least Daily Range 4°
Coldest Day 0°
Day of Month

Record of the Weather in Pittsburgh for December, 1924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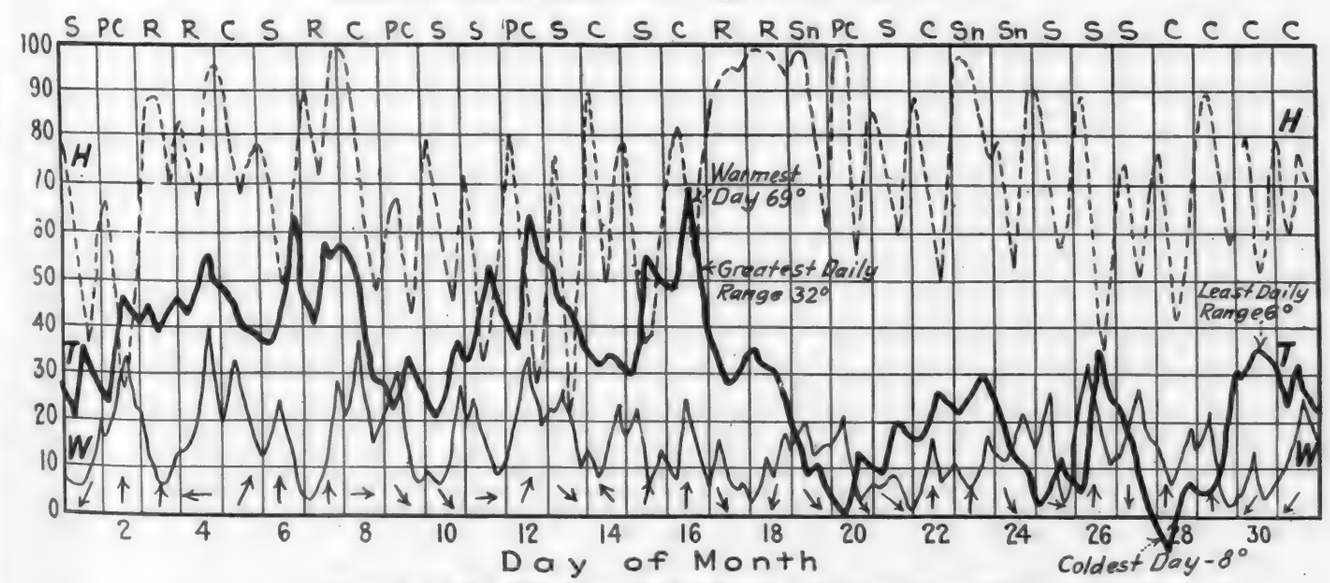
Warmest Day 56°
Greatest Daily Range 33°
Least Daily Range 4°
Coldest Day -18°
Day of Month

Record of the Weather in Chicago for December, 1924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Warmest Day 69°
Greatest Daily Range 32°
Least Daily Range 6°
Coldest Day -8°
Day of Month

Record of the Weather in St. Louis for December, 1924

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F. Light Lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M. Arrows fly with prevailing directions of wind.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow.

Correspondence

Flashing of Condensation in Return Pipes

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the query of G. D. C. on page 63 of the December number of THE HEATING AND VENTILATING MAGAZINE regarding "Flashing of Condensation in Return Pipes" of vacuum heating systems I think it is necessary only to call his attention to the fact that the 1 lb. of water, which he laboriously collects to be re-evaporated into steam, occupies roughly about 2,500 times the space it occupied before it was re-evaporated, or flashed back into steam.

When he considers that it requires as much displacement in a vacuum pump to handle a cubic foot of steam as to handle a cubic foot of water, the effect on the vacuum pump is readily understood.

Chattanooga, Tenn. H. C. RUSSELL.

EDITOR HEATING AND VENTILATING MAGAZINE:

In answer to the letter by, "G. D. C. New York," in your December number, it should be remembered that while 1 lb. of steam at that pressure, 9.34 lbs. absolute, does not amount to much in weight or heat content that it will occupy about 38 cu. ft. of space. While this steam will not be in one mass yet by being separated into bubbles along the small return lines and combining with the uncondensible gases will have a strong tendency to obstruct the passage of the water of condensation. These pipes being small, are easily steam or air-bound and a very small fraction of a pound of steam will do it.

I have tried an experiment here of taking a small 3 to 5-section radiator and connecting it in the line just beyond the thermostatic valve and with no valve between it and the vacuum lines. These radiators are generally so hot that the hand cannot be held on the radiator. This radiator seems to recondense the steam, or vapor, from the water passing through the thermostatic valve and while cooling it also conserves the heat that would otherwise be lost before the water of condensation reaches the vacuum pump.

Arkansas. L. E. B.

Whistling Noise in Gas Burners

EDITOR HEATING AND VENTILATING MAGAZINE:

I have read with interest the November issue in which you explained the possible cause of the whistling noise in a gas water boiler immediately after the burners are turned off. It has occurred to me that possibly this noise is caused by particles of condensation dripping down from the boiler sections on the hot burners. Very frequently condensation is formed on sections of water boilers but the particles that drip into the flame are immediately re-evaporated, the noise of the burner preventing this action being noticed. However, immediately after the burner cuts off, the dripping of condensation on the hot iron of the burner continues for two or three minutes and a distinct sizzling noise is noticed.

This might not be the cause of the noise noticed by your correspondent, but it is a noise that generally will exist where water at low temperatures is being circulated through gas boilers.

Baltimore, Md. EUGENE D. MILENER.
Assistant Superintendent of Fuel Sales, Consolidated Gas, Electric Light and Power Company of Baltimore.

Heat Transmission from Pipe Coils for Varied Sizes of Pipe and Heating Systems

Editor Heating and Ventilating Magazine:

I would appreciate it if you would kindly give me, through your correspondence columns, a formula to figure, when using pipe coils, how many lineal feet of pipe, first of 1-in., second of 1¼ in., third of 1½ in., and fourth of 2 in., are required for 1 sq. ft. of radiation:

1. In a hot water system.
2. In a vacuum-vapor system.
3. In a vacuum system.

A. Le F.

Montreal, Que.

The actual outside diameter of the pipes in question are 1.32, 1.66, 1.90 and 2.38 in., respectively. Corresponding square feet of heating surfaces per lineal foot of pipe are 0.346, 0.434, 0.494 and 0.622. For all practical purposes, figure 1/3 sq. ft. of outside surface per lineal foot of 1-in. pipe, ½ sq. ft. for 1½-in. pipe and ⅔ sq. ft. for 2-in. pipe. Tables are published giving the required data (see Standard Heating and Ventilating Data Sheets published by THE HEATING AND VENTILATING MAGAZINE for December, 1924), but if these or above data are at any time not at hand, multiply the outside diameter of pipe by 3.1416 (or 3 is good enough) and the product by 12, then divide by 144 to obtain the square feet of heating surface per lineal foot of the pipe.

Gravity water heating systems with open expansion tanks are usually figured for a maximum temperature of 180° at the boiler, with a drop of 20° through the system, thus having 160° in the return at the boiler, or an average temperature at the radiators of 170°. For such conditions the difference in temperature between the heating medium in the radiator and the air surrounding the radiator is 100°, but pressure water systems, using ordinary safety valves or mercury seals, as well as forced circulation systems with circulation pumps are often figured as high as 220° to 230°, thus frequently maintaining an average for the radiators of 210° in zero weather, or a temperature difference of 140°.

Steam heating systems are usually designed for the same temperature difference—steam at 210° and room at 70°, consequently no difference in transmission need be used whether the heating system is vapor, vacuum-vapor, or forced hot water, unless the temperature of the heating medium is other than 210°.

It all depends upon what steam or water temperature conditions the designer selects for the operation of the system for the extreme low outside temperature, usually zero in this locality. If he uses a low pressure steam, vacuum, vacuum-vapor, or vapor system that can operate above atmospheric pressure, (sometimes as high as 15 lbs. gauge pressure), it is then possible to design the system for the higher pressures when the extreme low outside temperature is reached, and for such conditions the radiation, being at higher temperatures, will of course give off more heat; but if a vapor system is used, having an open end to the atmosphere, then the system cannot be operated above atmospheric pressure and the circulating medium cannot be raised above 210°. It is often said, however, that the completeness of air and water removal effected by vapor and vacuum systems increases the heat transmission slightly.

Transmission from pipe coils in steam heating systems is usually taken as 300 B.T.U. regardless of their size, that is, 2 B.T.U. are transmitted hourly per square foot of radiating surface per degree of temperature difference. Many engineers design their heating systems for a steam temperature of 220° and a room temperature of 70°. For such conditions the temperature difference is 150°, which multiplied by 2 gives the transmission of 300 as stated above, but for the gravity water heating systems with conditions as assumed in the case previously given the transmission would only be 200 B.T.U.

Table 1, selected from "Heating Systems" by Raynes, an English author, gives the B.T.U. emitted per foot of run of various sizes of pipe per hour. Table 2 is the same thing presented in another way, as may be desired, that is, the B.T.U. transmitted are given per square foot of surface of pipe instead of per lineal foot of pipe.

TABLE 1—HEAT TRANSMISSION FROM PIPE COILS PER LINEAL FOOT OF PIPE

Mean temperature difference between heating medium and that of space warmed. Deg. F

Pipe Size In diam.	100	110	140	150
1	75	84	114	124
1¼	88	100	132	146
1½	98	112	150	164
2	116	131	178	195

TABLE 2—HEAT TRANSMISSION FROM PIPE COILS PER SQUARE FOOT OF PIPE SURFACE

Mean temperature difference between heating medium and that of space warmed. Deg. F

Pipe Size In diam.	100	110	140	150
1	217	243	329	358
1¼	203	230	304	336
1½	198	227	304	332
2	186	211	286	313

Other authorities differ in the heat transmission given for pipe coils, mainly because the heat transmitted varies not only with the size and number of pipes in the coil, but also according to the length and position of the coils, whether laid in a horizontal or vertical plane. Laid horizontally at the ceiling they are not so effective unless the building houses plenty of belts, shafting and machinery in motion producing air currents around the coils. Allen and Walker in "Heating and Ventilation" state that the B.T.U. per degree of temperature difference is 2.48, 2.30, and 2.12 for pipe coils, 4, 6, and 9 pipes high, respectively.

It may be also be pointed out that wall radiators transmit as much heat as pipe coils and for most heating installations are in many ways more desirable than pipe coils.

New York. T. W. REYNOLDS

Effect of Room Partitions in Figuring Radiation

EDITOR HEATING AND VENTILATING MAGAZINE:

Answering your correspondent of Chicago who questions the accuracy of estimating radiation by the cubic contents method where two rooms have the same exposures of wall and glass, I would comment as follows:

He is right in theory because the quantity of air infiltration depends upon the perimeter or outside boundary of the window openings. This being the case the cubic contents of the enclosed spaces would not enter into the problem. However, the air leakage being also dependent upon wind velocity and other factors of which little is generally known, it has long been customary to use the more convenient method of air change, using this with judgment and decreasing the number of air changes as the depth of the room increases in proportion to the same exposure of wall and glass.

This has always worked out in practice, especially as the heat required for raising the temperature of the air is but a small portion of the total heat requirements. Practically, it would not matter in the given examples whether the cubic contents were figured for the entire enclosure, or just for the two offices, as the difference in required radiation would only be about 1 sq. ft. It may also be said that there probably would be less leakage in the case of the two offices for with office doors closed there would be less liability of air circulating from openings around outside windows to openings around corridor door. This is borne out by the fact that were we working in the offices mentioned and the room was chilly we would soon close the office doors to reception room in order to be warmer.

For the benefit of those who would be more painstaking and who desire something more accurate than the cubic contents method, it may further be pointed out that tables are published giving the heat required per lineal foot of perimeter for windows, as in "Steam Heating" by Warren Webster & Co., of Camden, N. J.

New York.

Smaller Returns for Vapor Heating Systems

EDITOR HEATING AND VENTILATING MAGAZINE:

These are good days to bear in mind the well known, but sometimes forgotten fact that waste is always sinful. To get the most steam out of each pound of coal and then use this steam in the most efficient manner should be the ideal. So the question arises as to why such large return pipe sizes seem necessary to most designers of vapor heating systems.

On many a job the returns could very well be reduced to a slight extent, enough so that about 25% less air would have to be handled. The writer knows of two jobs exactly alike, with the exception that one has small returns, the other large returns. With the first the maximum amount of vacuum is reached much quicker than with the other and maintained much longer, simply because the returns have less air capacity and less leakage area. The vacuum is 8 in. for the first system in mind, 6 in. for the second.

With any vapor heating installation, even of fair size, the discharge from the vent, usually ½ in., is hardly noticeable. Likewise, if the main return is disconnected at the boiler, only a dribble of water will be found, a flow somewhat like the size of a lead pencil. Someone once installed a heating system using theoretical pipe sizes of only ¼ in. and the job worked satisfactorily and the writer has seen ¾ in. returns which also proved satisfactory. If, however, we do not use small pipe sizes, because of corrosion, we can at least use brass pipes for the smaller sizes. The labor on brass and iron pipes is about the same, if not the same, so that there should be very little difference in cost in place.

In starting up a vapor heating system the air is expelled from the radiators through the return until the steam reaches and closes the thermostatic valves. The air then remaining in the returns is not expelled through the vent valve, but is pulled backwards into the radiators whenever the radiators are under higher vacuum, due to condensation of steam faster than supplied. So if the returns are made smaller there will be less air drawn back into the radiators and the vaccum in the radiators will be that much the greater.

T. W. REYNOLDS.

New York City.

Long Range Weather Prophecy

Prophecies of summerless years and other seasonal catastrophies need have no disturbing effect upon business the Chamber of Commerce of the United States has concluded after consulting the Weather Bureau officials of the Federal Government. This assurance is given in response to an inquiry from one of its members.

In the first place it is contended that long range forecasting is not possible. A week at the outside is the limit fixed by scientists. It is conceded that changes in ocean temperatures might have some effect but not enough is known about ocean temperatures to afford any basis for prophecy. The summerless year, therefore, is in the lap of the gods and its approach cannot be foreseen until it is well upon us.

Shifts in Officers of Richmond Radiator Company

Following closely upon an announcement that P. H. Seward, long active vice-president had been made president of the Richmond Radiator Company, as well as general manager, the company has issued a further statement to the effect that new interests have acquired control of the Richmond Radiator Company and have recalled Colonel Lloyd G. McCrum as president and general manager.

Colonel McCrum had previously resigned over a difference of opinion regarding policy. As a result of this action a committee was formed representing George H. Burr & Company, W. A. Harriman & Company, Inc., and Moors & Cabot of Boston. The support of this committee, which obtained proxies for more than two-thirds of the stock, resulted in Colonel McCrum's election as head of the company.

The committee also elected four new directors to represent its interests. They are Noble Crandall, of George H. Burr & Company; Hamilton Pell, of W. A. Harriman & Company; James F. Curtis, attorney-at-law; and Floyd W. Parsons, engineer; succeeding F. O. Allen, P. S. Kaufman, Frederick H. Kennedy and John J. Duffy.

P. H. Seward, president and general manager since January 14, resigned both offices. He was elected to his former position of vice-president, but declined it. He will continue as a director. A. H. Schroth and W. G. Langford were elected vice-presidents in charge of sales and purchases, respectively.

At the annual meeting later this month the new management will discuss plans for liquidating approximately 75% of accumulated dividends due on the preferred stock.

Heating Contractors to Hold Annual Convention in Detroit

Detroit, Mich., has been chosen for the forthcoming thirty-sixth annual convention of the Heating and Piping Contractors' National Association. The dates are June 1 to 4, 1925. Headquarters will be at the new Brook-Cadillac Hotel.

Legal Decisions

No Lien for Furnishing Temporary Heat to Building under Construction Under Illinois Statute

The Illinois Supreme Court holds, Hoier v. Kaplan, 145 N. E. 243, that a heating contractor was not entitled under section 7 of the Illinois Mechanic's Lien Act, as amended in 1913, to a lien for furnishing temporary heat which was necessary in the construction of a building during winter for the protection of the plaster and cement work and for the comfort of the workmen. The section gives a lien for material if "it is shown that such material was delivered either to said owner or his agent for such building or improvement, or at the place where said building, or improvement was being constructed, for the purpose of being used in construction or for the purpose of being employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed forms or formwork where concrete, cement or like material is used, in whole or in part." The court holds that the phrases "used in said building or improvement," and "used in construction" denote use as a part of the construction, so that the material becomes a part of the completed structure.

"There are," the court says, "different degrees in which labor and material contribute to a completed structure, and a service which is indirect may be as essential to construction as that which is direct. Labor is necessary to furnish heat to preserve the interior construction of a building and to promote the comfort of workmen during the winter months. But necessity is not the test under our statute, whether a lien will attach. The question is whether the labor performed in furnishing such heat is labor performed in constructing the building, or whether it is labor performed in one of the processes of construction, as a means to assist in the erection of the building. It may be conceded that the heat gave the walls and floors the proper consistency, just as a tangible ingredient, if one had been invented for that purpose, would have done. Such an ingredient, when lodged in the completed structure, would be lienable, but it would be so only because it is within the terms of the statute. A lien for labor in furnishing heat in the construction of a building during cold weather may have reason to support it, but until such a lien is provided by the act we cannot extend its provisions to include it. The labor here performed in furnishing heat was not more necessary or closely connected with the actual construction of, nor did it enter more thoroughly into, the completed building as a constituent part than did the forms for cement work or the services of an architect in drawing plans and specifications before the amendment of the act allowing these items. Our statute makes a distinction between material delivered for the purpose of being used in the construction of a building and that used merely as a means in the process of construction, except where specifically provided by the act, as in the case of the forms and formwork above specified. If labor employed to afford temporary heat to insure the comfort of workmen will authorize a lien, then it may be argued that food provided for their sustenance, and even lodging, while they are exclusively employed upon a particular building or improvement, will likewise support a lien. No authority has been cited to the effect that furnishing heat for the comfort of the workmen or to insure proper plastering or cement work has been regarded as material entering into the building, or that labor in furnishing such heat has been labor performed in the building of the structure. No language in our statute justifies any such extension of its scope or meaning, nor can a lien for any such items be implied from its provisions."

This seems to be the only case of the kind involving temporary steam heat, but the plaintiff cited cases in other states where a lien was allowed for coal furnished in heating and drying a building, Crowell Lumber & Grain Co. v. Ryan, (Neb.) 193 N. W. 609, for gunpowder used in preparing ground for the building of an aqueduct, Lampson Co. v. Commonwealth, 202 Mass. 326, 88 N. E. 911, and other analogous cases. The Illinois court said, however, that these authorities, while very instructive, were not necessarily persuasive, since the provisions of mechanics' lien statutes of other states vary from that of Illinois; hence the decisions under them afforded little assistance in determining the question here involved. "Usually," the opinion adds, "the courts in those states have not applied, as is true here, the rule of strict construction in the interpretation of those statutes." The Illinois Supreme Court has uniformly held that the state statute relative to mechanics' liens is in derogation of the common law and that it must be strictly construed. "The lien should be enforced when the party brings himself within the provisions of the statute, but it should not be extended to cases not provided for by the language of the act, even though they may fall within its reason."

As to the question of the strict construction of the mechanics' lien laws, the courts of the various states, as indicated by the Illinois court, cannot be said to be in complete accord, some jurisdictions favoring a liberal rather than a strict construction.

Interest in Contracts by Members of Council Awarding Them

In a suit to compel the execution by the authorities of a city of a contract awarded to the plaintiff company by the governing board of the city for the performance of the plumbing, heating and ventilating work on a public building, for which the plaintiff had been the lowest bidder, it appeared that the plaintiff's sheet metal foreman was at the time of making the award a member of the city council and of the building committee thereof, but that he was not present at the meeting of the council at which the award of the contract was made. The California District Court of Appeal, Third District, holds, Stockton Plumbing & Supply Co. v. Wheeler, 229 Pac. 1020, that the plaintiff's foreman was interested in the contract and that the contract would be invalid within the meaning of Stockton City Charter, art. 6, §2, and art. 7, §2, providing that members of the city council shall not become financially interested in contracts awarded by the city, although the foreman did not receive direct pecuniary gain, and although the contract would have been more advantageous to the city than those proposed by the other bidders.

"It is conceded by counsel for the respondents," the court said, "that the contract itself is perfectly fair in all respects to the city and that neither Councilman Charlesworth nor his employer ever received or attempted to obtain any advantage by virtue of the position of Mr. Charlesworth as a member of the city council." It is also conceded that Charlesworth did not take an actual part in the awarding of the contract. But these propositions constitute no reply to the conclusion above announced, nor does the fact, if it be a fact, that the contract proposed to be awarded would, if accepted, be more advantageous to the city than the others proposed for the same work. It is the principle which must be observed and applied. In other words, it is not the character of the contract itself, but the manner in which it is created, that renders it violative of sound public policy."

Labor Survey in Steamfitting Trade

The Fall Labor Survey, which has been compiled by the Heating and Piping Contractors' National Association, contains data from 101 cities.

Very little change was made in wages during the six months covered by the survey. Wages were increased in seven cities and decreased in but two cities.

The median of wages for journeymansteamfitters is $1.12½ per hour. In

five cities the wage is less than $1.00 per hour ranging from 75 cents to 90 cents. Only three cities are paying the highest rate ($1.50 per hour).

The forty-four hour week is a well established practice. Five cities report a longer week and one city reports a forty hour week.

The overtime situation shows some improvement, several cities reporting decreases from double time to time and a half and some reported regular night shifts at regular time.

The supply of men indicates that the usual seasonal peak of employment is with us. Scarcity of men was reported by 33 cities while 34 others reported all men employed.
engineers, New York.

The training situation remains unchanged. Eleven cities report systematic training for prospective journeymen.

Residence of Professor Willis Luther Moore, Pasadena, Calif., Showing One of the Air Funnels

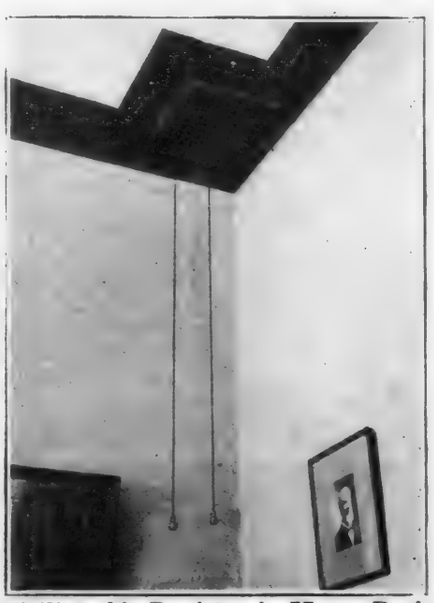
An Elaborate Air Purifier and Humidifier for the Home

Professor Willis Luther Moore, who was for eighteen years chief of the United States Weather Bureau, has designed an elaborate arrangement for cleaning, cooling, purifying and humidifying the air in his home at Pasadena, Calif. A general idea of the equipment, which is located on the roof of his home, may be had from the accompanying illustrations.

The outstanding feature of Professor Moore's apparatus is found in two funnels placed on the roof. One is arranged so that it always faces the wind; the other, which carries off the used air, is turned away from the wind.

Professor Moore Taking Hydrometer Reading at His Home

Air Cleaning, Cooling, Purifying and Humidifying Apparatus on Roof of Moore Residence, Pasadena, Calif.



Ceiling Air Register in Moore Residence

Just below the intake funnel is the water through which the air is forced.

The washed air is carried from this section to the various rooms of the home, each of which is equipped with two registers; one to admit the conditioned air, and the other to carry off the used air.

(*Heating and Ventilating Magazine, February*, 1925)

How To Heat Your Home

(This is the fifth of a series of articles giving practical information of fuels and furnaces.)

V. How to Burn Coke

By Samuel S. Wyer

Associate in Mineral Technology, U. S. Smithsonian Institution.
(Science Service)

WHEN using "man-made anthracite" or coke, follow the rules below:

1. Carry a deep bed of fuel; a bed about 18 in. thick gives best results.
2. Use very little draft after the fire is started and keep it always under control.
3. Do not stir the fuel. Clean the fire in the morning, if possible.
4. Use sized coke; ½ in. to 2 for furnaces, boilers, and stoves; ½ in. to 4 in. for open grates.
5. Do not allow ashes to accumulate in ash pit.

Coke is the solid residue, carbon and ash, left when bituminous coal is heated without access to air. It burns with a smokeless flame and has aptly been called a "man-made anthracite" and can be used easily in existing appliances to replace anthracite.

The coke must not be too hard. The best size is between ½ in. and 2 in. The screenings should be delivered with the coke because they are needed for banking fires.

For starting a fire in an ordinary furnace or boiler in a six to ten-room residence, about 10 to 15 lbs. of kindling wood are needed. When the wood is well ignited it should be covered with a layer of coke about 6 in. thick. It will usually take one hour to get this first layer of coke burning well. All the available draft should be used to start a fire; the stronger the draft the sooner the fire will start.

After the first layer of coke is ignited the furnace should be filled to a depth of 14 to 18 in. A thick fuel bed helps to check the draft and gives a slow uniform combustion and uniform temperature in the house. With a thick fuel bed the fire will last a long time without requiring attention. If a thin fuel bed is carried the coke burns too fast in giving a hot uneven fire that burns out quickly and requires frequent firing. A thin fire also tends to produce more clinkers.

To get good results from a coke fire the draft must be kept under control. The amount of draft required depends on the weather conditions and the size of the coke. Generally speaking, it takes much less draft to burn coke than it does to burn anthracite or bituminous coal. If too strong a draft is used after the fire is started, the coke will burn too fast, making the house too hot and requiring frequent firing.

A coke fire requires less shaking of the grate than a coal fire. In ordinary weather one shaking a day, preferably in the morning, is all that will be necessary. Some people who have burned coke for many years say that they get better results if they have a layer of ashes about 1 in. to 2 in. thick on the grate all the time. The ashes help to check the draft and keep the hot coke from coming in contact with the grate.

For banking the fire, the fines from the coke pile should be used. The fines make a denser fuel, reduce the draft through the fuel bed, and thus help in keeping the fire. The fuel bed may be made still denser by lightly tapping the coke on the top with a poker or shovel. The ash pit door should be closed as tightly as possible and the draft in the furnace reduced by opening the check damper. If the ash pit door does not fit tightly, it may be necessary to open the damper in the firing door in order to keep the fire over night.

If a good bed of hot coke about 6 in. thick is on the grate, the grate may be shaken, clinkers removed, the fire leveled, and a heavy charge of coke placed on the furnace. Opening the damper in the ash pit and closing the check damper in the smoke pipe will help to start the fire quickly. After about half an hour, when the freshly-fired coke has been well ignited, the damper in the ash pit door can be nearly closed and the check damper partly opened. If the fire is almost burned out do not shake the grate or remove the clinkers, but level the fire with a poker, slightly stirring it so as to shake some of the ashes down and then fire about a six inch layer of coke.

(*Next month*: *How to Burn Gas.*)

National Trade Extension Bureau

"Ask 'Em to Buy" Campaign

Acting on a suggestion of the sales and advertising managers in the heating and plumbing industries, the National Trade Extension Bureau announces the inauguration of an "Ask 'Em to Buy" campaign. This campaign will be directed to heating contractors and master plumbers.

In analyzing the sales situation, the T.E.B. feels that there has been a lack, on the part of the trade, to ask people to buy. The Bureau also finds it necessary that the sales and advertising managers of the various concerns keep in touch constantly with this movement. They can best do this by making sure they are listed with the T. E. B. "Ask 'Em to Buy" campaign. They will in this way get all the helps and suggestions sent out which are so necessary to unify the movement and thus get better results.

The first announcement has already been issued to 5700 salesmen on December 10, 1924. On various dates in December and January, sales literature was sent to both salesmen and manufacturers, in a follow-up mail system, so that the sales points would be brought out more vividly by repetition and elaboration.

Letters were also sent to local associations of heating contractors and master plumbers and to trade papers in this field.

According to plans for the campaign, it will be continued through February into the spring.

Among the features of the campaign are the use of posters and calendars for display in association rooms, telephone cards for the mouthpieces bearing the words, "Ask 'Em to Buy," stickers to be placed on both stationery and wherever they will do the most good. There is also a booklet on the subject to be sold to manufacturers and wholesalers at cost for distribution to their customers.

T. E. B. Sales Campaigns for 1925

In a calendar issued by the National Trade Extension Bureau the sales campaigns for each month during 1925 are listed. These are: January, "Better Relations with the Public"; February, "Better Sanitation in Public Places"; March, "Heat By Radiators"; April, "A Bath in Every Home"; May, "Hot Water For Every Need"; June, "A Bath-A-Day"; July, "During This Month Clean Up Previous Sales Drives"; August, "Suburban Water Systems and Sewerage Disposal"; September, "Automatic Heat Regulation"; October, "More and Better Water Closets"; November, "Star Planning for Xmas Business"; December, "Domestic Appliances As Christmas Gifts."

Coming Own-Your-Home Expositions

Plans are announced for the Chicago, New York, Philadelphia and Buffalo Own-Your-Home Expositions. The

Chicago show is scheduled for March 21 to 28 at the Coliseum; the New York Seventh Annual Own-Your-Home Exposition in the Sixty-Ninth Regiment Armory from April 18 to 25; the Philadelphia First Annual Own-Your-Home Exposition in the Commercial Museum, from May 9 to 16 and the Buffalo First Annual Own-Your-Home Exposition at the Broadway Auditorium, May 30 to June 6.

These shows will include comprehensive displays of heating and ventilating apparatus. A feature of the Chicago show will be a house in process of construction arranged to show good construction methods and the proper uses of different materials and equipment.

The head of the heating and ventilating committee for the Chicago exposition is Homer R. Linn, president of the Illinois Chapter. W. J. Olvany, president of the New York Chapter, heads the committee for the New York exposition and R. C. Bolsinger, Fowler & Wolf Manufacturing Co., is chairman of the Philadelphia exposition heating and ventilating committee. The Buffalo committee will be announced later.

1925 To Equal 1924 as a Building Year

Perhaps the most interesting statistical development in the building field during the past few years has been the Annual Building Survey and Forecast by *The Architectural Forum*. For the past three years, since the institution of this annual forecast, the *Forum* prediction as made the first of each year, has been within 3% correct when compared with actual figures at the end of the year. This forecast of building activity is based on a comprehensive survey carried out through individual reports from a large number of architects and from building contractors, bankers and others directly interested in the construction field. The investigation is made in nineteen building types and covers each state. Percentage comparisons are made with the previous year in each classification, so that there is provided not only a definite measure of activity in each district, but a relative measure of the increase or decrease of public interest in the particular building type in question.

TABLE 2.—PERCENTAGE OF PUBLIC DEMAND FOR NEW BUILDINGS IN 1925 AS COMPARED WITH 1924

Type of Building	Northeastern States		North Atlantic States		Southeastern States		Southwestern States		[illegible] States		[illegible] States		United [illegible]	
	1924 %	1925 %	1924 %	1925 %	1924 %	1925 %	1924 %	1925 %	1924 %	1925 %	1924 %	1925 %	1924 %	1925 %
Automotive	4 4	3 2	3 1	2	1 8	2	2	2 8	2 4	3 3	1 8	4	2 6	2 9
Banks	6 9	1 6	4 9	4 4	3 2	3 4	1 8	4 4	3 1	2 9	11	2 6	3.7	3 3
Apartments	8 1	9 5	12 7	15 6	8 2	10 6	8	9 1	8.	10 1	16.	6 6	9.8	10 2
Apartment Hotels	7 2	3 6	6 3	3 8	2 1	4 1	1	4 7	8 6	4 6	5	3 4	5	4
Club and Fraternal	5 4	7 4	4 4	5 9	6 1	4 1	11	4 3	6 8	7 5	4 9	6 5	5 6	6
Community and Memorial	7	1 7	1 6	1 3	7	8	2 2	1 1	9	9	2 8	1 6	1 5	1 2
Churches	5 1	5 4	4 8	5 9	6 9	9 4	7	11 9	4 8	9 2	5 9	6 3	5 8	8
Dwellings (under $20,000)	4 2	3 8	6 3	6	3 8	11	4 2	3 8	2 7	3 9	3 2	3 6	4 1	4 5
Dwellings ($20,000 to $50,000)	2 7	2 2	3	2 1	2 4	3 6	2 5	1 7	1 4	1 9	1 2	1 9	2 2	2 2
Dwellings (above $50,000)	2 6	1 1	1 8	1 3	9	9	1 9	1 4	8	11	1 3	1 2	1 6	1 1
Hotels	6 1	8 1	9 5	5 4	23 6	17 6	15 9	6	11 8	10	11	8	13.	9 2
Hospitals	3 4	3 3	5 7	4 9	3 4	2 8	6 9	5 11	6 2	3 9	4 6	6 7	5	4 5
Industrial	8 2	9 1	10 1	6 3	4 7	4.	2 8	4 4	7 7	11.	4 7	6 3	6 5	6 9
Office Buildings	4 5	9 4	7	12 2	7 1	6 9	13 1	11 4	9 2	6 3	13 3	11 6	9.	9 6
Public Buildings	2 3	1 11	1 3	2 9	2 11	2 7	6 4	4 2	2 8	3 2	3 3	8 9	3 1	4
Schools	18 4	18 9	12 9	14 5	19 1	15 2	11 4	16 4	15 4	14 2	12 5	11 6	15	15 1
Stores	1 11	3 7	2 1	2 11	1 11	2 8	1 3	2 1	3 1	2 7	2 7	3 11	2 1	2 9
Theatres	7	5 8	1 8	2	1	2 11	6 9	2 7	3 7	2 6	2 3	3 4	3 8	3 2
Welfare (Y. M. C. A. etc.)	1.	3	7	1	5	.7	1 7	2.	.6	9	1 5	2 2	1	1 2

The accompanying tabulation represents the 1925 forecast in detail which indicates another $5,000,000,000 building year, the actual figure determined by the survey being $4,992,318,000.

This survey was conducted in exactly the same manner as the previous ones. In January, 1924, the published forecast predicted an expenditure of $5,560,367,700 during that year. Figures now available prove that this prediction was correct within 3%.

FACTORS INFLUENCING 1925 BUILDING

The basic elements which were used to establish the total volume of building for the year include the following:

An established shortage of buildings.

Public confidence in the building situation.

Stabilized costs.

Good transportation conditions.

Ample mortgage money.

Good labor conditions.

TABLE 1.—MONEY VALUE OF PROSPECTIVE NEW BUILDING CONSTRUCTION IN THE UNITED STATES FOR THE YEAR 1925

BUILDING TYPES	N. EASTERN STATES	N. ATLANTIC STATES	S. EASTERN STATES	S. WESTERN STATES	MIDDLE STATES	WESTERN STATES	U.S.A.
Automotive	$13,038,000	$37,896,000	$3,381,000	$8,604,000	$53,691,000	$25,848,000	$142,458,000
Banks	6,939,000	79,770,000	6,255,000	13,791,000	46,431,000	16,935,000	170,121,000
Apartments	39,879,000	284,931,000	19,077,000	28,881,000	163,779,000	42,810,000	579,357,000
Apartment Hotels	15,030,000	69,270,000	7,275,000	14,670,000	75,165,000	21,945,000	203,355,000
Clubs Fraternal, etc	31,020,000	107,028,000	7,455,000	13,689,000	121,317,000	41,283,000	321,792,000
Community Memorial	7,023,000	24,054,000	765,000	3,765,000	14,454,000	10,971,000	61,032,000
Churches	22,389,000	106,740,000	16,905,000	37,494,000	150,063,000	39,885,000	373,476,000
Dwellings (Under $20,000)	15,837,000	109,281,000	10,809,000	11,904,000	64,497,000	23,394,000	235,722,000
Dwellings ($20,000 to $50,000)	9,303,000	36,636,000	6,594,000	5,622,000	31,086,000	12,699,000	101,940,000
Dwellings (Over $50,000)	4,710,000	21,717,000	1,620,000	4,635,000	15,036,000	7,812,000	55,530,000
Hotels	33,615,000	95,874,000	31,710,000	19,035,000	160,824,000	52,635,000	393,693,000
Hospitals	13,620,000	88,770,000	4,980,000	17,448,000	61,395,000	42,825,000	229,038,000
Industrial	37,770,000	115,089,000	7,191,000	13,698,000	178,050,000	40,569,000	392,367,000
Office Buildings	39,303,000	222,441,000	12,426,000	36,039,000	103,359,000	75,051,000	488,619,000
Public Buildings	8,103,000	51,981,000	4,911,000	12,666,000	51,510,000	57,930,000	187,101,000
Schools	79,335,000	263,784,000	27,291,000	51,687,000	229,641,000	75,120,000	726,858,000
Stores	15,630,000	45,030,000	4,965,000	6,708,000	41,685,000	23,220,000	137,238,000
Theaters	24,450,000	36,495,000	4,944,000	8,484,000	40,512,000	21,096,000	135,981,000
Welfare Y.M.C.A., etc	1,353,000	18,417,000	1,305,000	6,171,000	15,096,000	14,298,000	56,640,000
TOTAL VALUE OF NEW BUILDINGS	$418,347,000	$1,815,204,000	$179,859,000	$314,991,000	$1,617,591,000	$646,326,000	$4,992,318,000

Sound general business conditions.

COMPARATIVE ACTIVITY IN VARIOUS BUILDING TYPES DURING 1925

To demonstrate the use of Table 2 we may take for instance the situation of bank building in the northeastern States for 1925 as compared to 1924. In the chart, the figures show that the bank building in the forecast for 1924 in the northeastern States represented 6.9% of total prospective building for that district. In 1925 bank building represents only 1.6% of the total forecast for the district. This comparison indicates that there will be much less bank building in the northeastern States during 1925 than in 1924. On the other hand, the office building situation in this district evidences twice as much activity in 1925. Similarly comparisons may be made for the nineteen building types in six geographical divisions of the country.

New Apparatus and Appliances

Dahlquist Aquatherm Copper Range Boiler

On the occasion of the twenty-fifth anniversary of the organization of the Dahlquist Mfg. Company, of South Boston, Mass., which marks also the twenty-fifth anniversary of the business career, in this field, of Theodore Dahlquist, the company has placed on the market a new type of boiler which

New Dahlquist Aquatherm Copper Range Boiler

will be known as the Dahlquist Aquatherm copper range boiler. This unit, it is stated, will reduce by one-half the cost of installing a gas tank heater and is intended to provide hot water instantaneously either from the usual gas tank heater, coal range, water back, indirect heater, coil in boiler or furnace, or electric heater, as the hot water is conducted direct from the heating source to the point of use. When hot water is not being drawn off, it is discharged through ports into the range boiler which becomes a storage system giving the arrangement the characteristics of a combined range boiler, instantaneous water heater and storage system.

The Dahlquist Aquatherm is also furnished separately to be installed in any other range boiler now in use, whether the water is to be heated by gas, coal, wood, or electricity.

A Dual Thermostat for Day and Night Operation

Something new in the way of a thermostat for furnishing one temperature during the day-time and another temperature at night, the operation being from a single push button, has been developed by the Johnson Service Co., Milwaukee, Wis., and is being marketed under the name of the Dual thermostat. This new device is a combination of the pneumatic thermostat which was invented by W. S. Johnson, and the two-pressure, or night-and-day thermostat, invented by James F. Gallagher. With this device installed in a building, states the company, the engineer in his office or the principal in his office can shut off the heat in the rooms not to be used, or regulate them automatically at a low temperature, thus saving fuel merely by pushing a button at the close of the day's session. In the morning, by again pushing the same button, all of the rooms can be restored to their normal day-time operating condition.

Also, in rooms used during the day-time, but not at night, the Dual thermostat may be arranged to shut off the heat automatically at the proper time. The additional charge, it is stated, over an ordinary system of temperature regulation is small, while the savings possible may become quite large.

Developments in Industrial Standardization During 1924

According to an announcement of the American Engineering Standards Committee there were notable developments in 1924 in the industrial standardization movement including important progress in the mechanical and mining industries. The safety field and managerial and trade association activities both here and abroad have also shown great progress.

This interest on the part of management is shown by the fact the standardization is becoming one of the most important and appreciated activities of trade associations. For example, 150 trade associations are officially participating in the work of the A E S C through accredited representatives.

In all, about 70 standards have been approved by the American Engineering Standards Committee, and 100 others are under way. Of these, 32 have to do with civil engineering, and the building trades; 26 with mechanical engineering; 15 with electrical engineering; 4 with automotive subjects; 11 with transport; 1 with ships and their machinery; 14 with ferrous metals; 15 with non-ferrous metals; 12 with chemical subjects; 2 with textiles; 16 with mining; 5 with the wood industry; 1 with the paper and pulp industry; and 11 projects with topics of a miscellaneous or general character.

The most important piece of work completed by the A E S C in the mechanical field during 1924 was the promulgation of the standard for screw threads, a subject which touches practically every industry. This was worked out in cooperation with the National Screw Thread Commission. Good progress has been made in two other far-reaching subjects, gages and systems of gaging, and pipe flanges and fittings. Parts of the work on both of these subjects are now nearly ready and will be issued soon.

The third year of the work of Mr. Hoover's Division of Simplified Practice has shown extensive development. In all, 26 simplifications have already been carried through, 10 others are in the final stages, and 45 additional surveys are now under way. Two hundred industrial groups are cooperating in the various projects.

The U. S. Chamber of Commerce and the A E S C are cooperating closely in this work. In general, the Division concentrates upon such eliminations as it is possible to carry out from a survey of statistical production data alone.

OLD HOMES MADE NEW, devoted to the development and improvement of homes from a utility and improvement standpoint, is the name of a booklet published by the *American Lumberman*. It shows clearly by means of overlapping photographs, the old type house and the same house after it has been renovated and beautified. The idea is taking hold rapidly as proven by the great demand for these books.

THE STATE OF BUSINESS

Marked Improvement Indicated

Manufacturers' Profit Margin Normal—Credit Situation Requires Attention

Especially Prepared for the THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn Schmidt

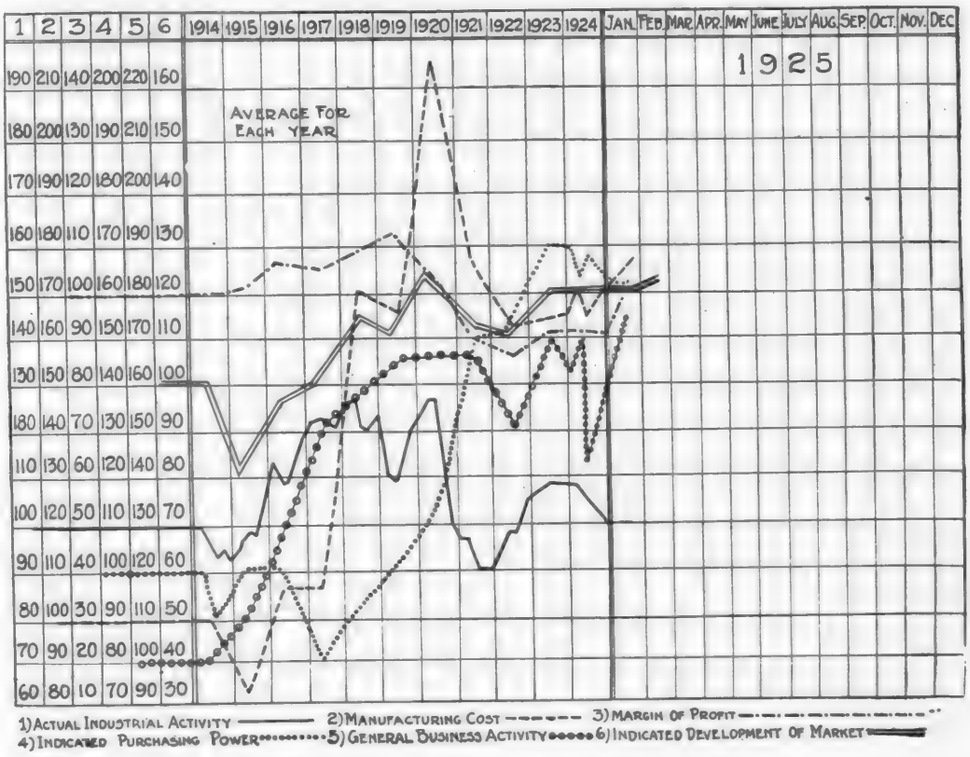
THE last month has aided greatly in clarifying the situation. It has intensified the general tendency for a economic improvement which now should proceed without further hindrance. For the student of market phenomena, and every manufacturer and merchant should apply himself to this very profitable science, the present constellation of the market contains a number of rather interesting features. Market strength or weakness is measured as a rule by the respective energy of certain leading industries. In times of a general prosperity these industries act as a rule in absolute harmony, sharing equally in the general advancement. No such harmony, however, is noticeable during the present economic period, and while, for instance, the steel industry is very busy there come still serious complaints from certain branches of the textile industry. This occurrence, for which other examples might easily be quoted, demands some investigation.

To understand the present development it is necessary to divide the various industrial groups in what for this purpose might be called primary and secondary industries. The first are those which develop a raw material for further improvement, the second are those which turn an improved new material into consumers' mechandise.

Just now prosperity seems to have struck the primary industries leaving the secondary and later groups still more or less in the cold. While this, no doubt, is very inconvenient for the secondary and later improvement groups of the national industry, it is by itself an exceedingly satisfactory sign, because it indicates an economic reconstruction of the national markets from the bottom upwards, a condition which indicates invariably a particularly strong upward movement of the economic wave. It proves conclusively that the receding movement of last year has stopped and that the market has accumulated strength for a very strong upward move which most likely will carry it to a new record.

This view is supported by the fact that our industry for the first time since the war has reached again a normal margin of profit, provided we accept the profit margin obtained during the year 1914 as normal. This development has been indicated already for several months by the slow rise in the price of manufactured merchandise combined with the steady adjustment of wages.

All through the years following the war our manufacturers have attempted to bring about a more satisfactory balance between manufacturing cost and wholesale prices. Wages were climbing rapidly, so was the cost of most raw materials, while the sluggishness of the retail market continued to have a depressing influence upon retail prices. Now the buyers' strike apparently has come to an end. Maybe the



Analysis of Business Conditions at End of January

consumer has exhausted his last reserves of merchandise and has been compelled to enter again the market, may be also, that his view of what constitutes an attractive price has undergone a change.

Whatever the cause, there exists the inclination to pay better prices, which has been utilized readily by manufacturers and dealers alike for the purpose of establishing a better margin between cost and sales price.

Such an occurrence is an exceedingly pleasing one. It is in fact so satisfactory that it is necessary to caution against overdoing a good thing. By one means or another the consumer has been coaxed again in the market. It is absolutely necessary now that his custom should be preserved and that he should not be frightened again into his former attitude of abstention from buying by excessive prices. This is the most necessary, as there are indications of a slight decline in the purchasing power of the consumer, caused by a steady rise of food prices which is not counterbalanced sufficiently by a similar increase in earning power.

Another feature which should be guarded against is the throwing upon the market of merchandise at exceedingly low prices caused by enforced sales of manufacturers stock left over from the last season or the result of forced sales to obtain money. Sales of the later kind have been especially numerous shortly before Christmas, to facilitate the New Year's settlement and to provide funds for supporting weakened banking credits.

Manufacturers and jobbers complain about lack of funds as they have difficulty of obtaining settlement from their dealer customers, who are very slow indeed with payments.

It is this aspect of the present situation which will require careful and circumspect attention during the next months, before the start of the Spring season. During the economic expansion following the war was accompanied by a general rise in the level of personal comfort. We have accustomed ourselves to many luxuries, the enjoyment of which has materially added to the personal overhead and which we are loath now to give up when earnings have decreased. Hence most of us have lived upon a more costly plan during the last year as we were really entitled to. The money has come from the income of business and industry and a larger share has been withdrawn in consequence of the nation's working capital than has been good for the solidity of the financial structure. Now payments cannot be deferred much longer and there is a general shortage of working capital. The retailer operates in consequence upon a hand to mouth basis, which is all but satisfactory. The present economic improvement may help to right the situation, but just now retailer, jobber and manufacturer feel the pinch.

Assistance, no doubt, will come from the banks as soon as the improvement is an accomplished fact. But the banks have had an unusual demand for accommodation from speculative quarters, as evidenced by the unusual large clearings in all stock exchange circles. It is desirable that part of this money be now mobilized for the use of industrial production so as to enable the market to acquire new stocks of merchandise. As it is, it is doubtful whether the industry and jobber will be able to carry the retailer unaided. The retailer in turn will have to help by making it an invariable rule to settle all accounts when due, and by placing orders sufficiently ahead as to permit the most economic distribution of manufacturing efforts.

Coöperation in this respect will materially aid in clearing the credit tangle and will soon make felt the coming wave of prosperity uniformly all over the market.

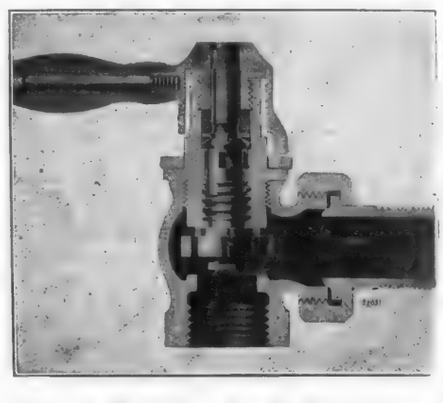
New Trade Publications

HEATING RATES, 1924–1925, in effect throughout the United States for district heating, as compiled by the National District Heating Association, are contained in a bulletin issued by the Ric-wiL Co., Cleveland, O. Rates are given for 119 steam heating companies and for 25 water heating companies.

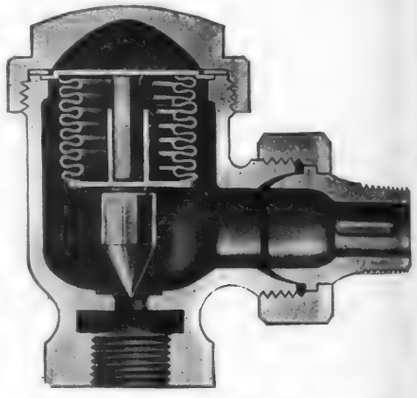
ENGINEERING ACHIEVEMENTS OF THE WESTINGHOUSE COMPANY DURING 1924, compiled by H. W. Cope, is the subject of a publication issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. There is a complete index for this copious work with illustrations throughout, encompassing the electric field, from huge turbines, generators and locomotives down to the smallest radio parts and the most delicate of instruments. This book which ends with a bibliography, brings out vividly and interestingly, the great progress in this industry during the last year. Size 8½-in. x 11-in. Pp. 52.

ARCA AUTOMATIC REGULATORS is the name of a booklet issued by Arca Regulators, Inc., New York. In it is described the principle and some of the applications of this product. The compiler writes that these regulators are used extensively in factories, hospitals, and churches, for controlling the temperature and humidity of the air.

SARCO-GORTON SYSTEM, combining the Sarco radiator trap Type-E and the Gorton packing lock modulating valve No. 8, for use in a two-pipe vapor vacuum or low-pressure heating system, is announced in a new bulletin (No. 7) issued by Sarco Co. Inc., Woolworth Bldg., New York. The Gorton valve



Gorton Packing Lock Modulating Valve No. 8



Sarco Radiator Trap Type-E

with its tight-locking stem and the Sarco trap with its full clearance and designed for positive action, are featured as a combination for giving quick clearance of water of condensation and air. The circular includes special data on the Gorton valve in sizes from ⅛-in. to 1¼-in., and for the Sarco radiator trap in sizes from ½-in. to 1-in.

CRESCENT INDUSTRIAL THERMOMETERS for all industrial requirements are featured in a catalogue issued recently by the American Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. All of the standard types are catalogued, together with brief but comprehensive descriptions of their respective uses. A number of thermometers are also shown constructed in accordance with specifications which have become standardized through extensive practice. Size 7¾ x 10½ in. Pp. 48.

BRYANT GAS BOILERS are the subject of a well-arranged series of sheets, arranged in data book form, issued by the Bryant Heater & Mfg. Co., Cleveland, O. The sheets cover diagrams, types of boilers, ratings, selections, room temperatures, regulation, regulators and various types of gas valves. Those interested in gas heating work will find these sheets a handy manual to have

on their desk. Size 7¾ x 10¾ in. Pp. 20.

TAG-HESPE RED READING COLUMN for thermometers, used with mercury thermometers only and designed to eliminate the difficulties of thermometer reading regardless of its position, is described in a circular issued by the C. J. Tagliabue Mfg. Co., 18-88 33rd St., Brooklyn, N. Y. The difficulties attending thermometer readings, it is stated, have often been the cause of neglect. The Tag-Hespe red reading column has a broad line of red showing from the top of the mercury column to the top of the tube. It is thus easy to follow down the red column to the top of the mercury column and take a reading.

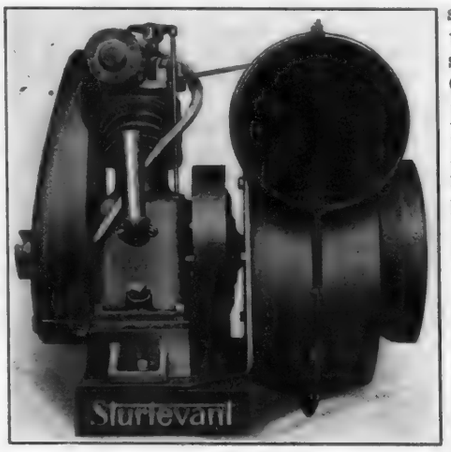
WEATHER VEIN, VOL. 5, No. 1, 1925, the periodical of the Carrier Engineering Corp., Newark, N. J., is devoted to a description of candy making and the part played by correct and constant temperature and air conditions in the manufacture of this product. The number describes in particular the air conditioning equipment in the Whitman candy factories which includes three 75-ton refrigerating machines, affording 100% automatic refrigeration in a minimum of space, with simplicity and fewness of parts and safety from the danger and discomfort of ammonia. All of the air which is delivered to the manufacturing departments of the Whitman factories is also washed and cooled and conditioned by means of automatic Carrier equipment.

AMERICAN BLOWER DIRECT-FIRED HEATERS is the name of a folder published by the American Blower Co., Detroit, Mich. This folder describes these heaters as excellent for use in places where a simple, dependable and economical heating plant is needed. Direct-fired heaters are described as being 67% efficient. They are fired like a stove or furnace and as their capacity and construction enable them to hold fire for hours, the disadvantages of stoves are done away with. The equipment includes a fan for directing the current of air over the heating surface, causing it to radiate more heat and giving circulation over a large area. This company also issues a bulletin (No. 1218) on "Venturafin Unit Heaters." In this booklet the Venturafin type of heater is fully described, and illustrated with diagrams and views of installations. These heaters, as already described in these columns, are unique in that they make use of a peculiar form of tubular construction. The steam tubes are of thin copper, offering little resistance to the passage of heat. The tubes are also wound with a helical brass "fin" which, it is stated, increases threefold their ordinary heat radiating surface.

STERLCO HEATING SPECIALITIES AND PUMPS, including vacuum air vents, safety valves, street ells, strainers, pumps, traps, valves and controls are the subject of a recent circular issued by the Sterling Engineering Co., Milwaukee, Wis.

GREETINGS ON OUR 88TH SEASON is a circular featuring the history of the Richardson and Boynton Company, since its foundation in 1837. An idea of the company's growth is given in the size of the first Richardson and Boynton factory, as compared with the company's present modern plant at Dover, N. J.

STURTEVANT GASO-FAN, announced as a new portable ventilating fan, driven by a ¾ H. P. gasoline engine, is presented in a folder issued by B. F. Sturtevant Co., Boston, Mass. This portable gas engine driven fan is available for ventilating manholes, tanks, tank cars and vats. It is described as especially useful in places where fresh air is wanted and electric-



Sturtevant Gaso-Fan

ity is not available. The fan is made in two types, one direct-driven, the other belt-driven, with capacities ranging from 275 to 1050 cu. ft. per minute for the direct-driven unit and from 300 to 1250 cu. ft. per minute for the belt-driven unit. As the magneto is contained in the fly wheel, no batteries are necessary. The gasoline tank is located in the base of the engine.

UNIVENT VENTILATION, with special reference to new models R and S, are featured in a catalogue issued by Herman Nelson Corporation, Moline, Ill. These units as already described in these columns, are made up with Univent copper radiators and Univent filters. The catalogue also treats of a short history of ventilation from the gravity system to the advent of the unit system. Size 11 x 8½ in. Pp. 36.

WATERBURY SEAMLESS FURNACE, featured as sealed forever against leakage of gas and dirt by molten steel, is described and featured in a booklet issued by The Waterman-Waterbury Co., Minneapolis, Minn. Interesting data and pictures are presented covering the history of this product from the molten pig iron to the finished state. Another catalogue issued by the company deals, amongst other products, with Waterbury school heaters.

MOLINE HEAT for buildings of every size and character is the subject of a handsome catalogue issued by Herman Nelson Corp., Moline, Ill. Sections are included dealing with building construction, chimneys, and boiler and radiator selection. The catalogue then takes up the Moline system which is described at length, the text being accompanied by numerous diagrams showing the operation of the system. Special attention is directed to the unit control of each radiator obtained with this system. The concluding sections of the catalogue are devoted to the various devices used, including the Moline radiator supply valves, distributing fittings, return valves, ejector and condenser arrangement, air relief valves, vacuum valves, anti-syphon seal, pressure seals and regulators. Size 8 x 11 in. Pp. 60.

PEERLESS GAS BOILERS, including specifications, data and useful information, are the subject of a set of data sheets published by Peerless Heater Co., Pittsburgh, Pa. They are issued to accompany the manual on house heating, recently published by the American Gas Association. Another new publication issued by this company is devoted to "Home Comfort with Gas Fuel," written for the householder.

HEAT WITH FORCED AIR is the title of a folder received from the Domestic Appliance Co., Cleveland, O., describing the construction and operation of the Automatic furnace fan. This fan is used either as a gravity or a mechanical device, operating on ordinary house current. Patented louvres are provided which swing open when the fan is not operating, giving a large free area for gravity circulation, and swing to a closed position, making a tight intake, when the fan is operating.

BARTON PORTABLE PUMP is described as a practical pumping equipment for construction and road work in Bulletin No. 56, issued by the American Steam Pump Co., Battle Creek, Mich. Various arrangements of these pumps are shown operated in the field by the engines of automobiles.

SOME PROPERTIES OF DOUCIL, a new base exchanging silicate, as a water softener, are described in a paper by James G. Vail which was read and discussed at a recent meeting of the American Institute of Chemical Engineers. This paper is now out in booklet form through the courtesy of the American Doucil Company, Philadelphia, Pa.

I-S-C VAPOR AND VACUUM SYSTEM OF STEAM HEATING BULLETIN, issued by the Ideal Specialty Co., San Francisco, Calif., shows in detail the company's modulating packless valve, quick vent valves, return-line valves, positive return traps and drip traps, with a detailed plan showing these connected in a heating system. The thermostatic valve uses a special composition brass bellows. A unique idea is applied in

the design of the I. S. C. return-line valve which is fitted with a sleeve containing a monel metal ball. The ball is placed so that the water of condensation may flow over the ball and valve seat in such a way as to flush the ball and seat and in this manner keep them washed. When the supply valve is closed the ball is intended to seat itself, thereby shutting off the radiator from back pressure and at the same time producing a high vacuum in the radiator.

LAYING THE GHOST is the title of a circular containing a copy of a letter addressed by the Athey Co., Chicago, Ill., manufacturer of the Athey cloth-lined metal weather strip, to McKenzie, Voorhees & Gmelin, architects, of New York. The letter deals with some tests which, the Athey company states, were made in 1915 by McKenzie, Voorhees & Gmelin on an Athey cloth-lined metal weather strip. Up to the time of writing the letter, neither the Athey Company nor the architects had been able to locate the original copy of the test sheet in question. In fact, the architects could find no record of having made this particular test. At any rate, the test was not included in the original report of the architects made to the American Telephone & Telegraph Company, dealing with experiments with various types of weather stripping. The point of the matter, from the standpoint of the Athey Company, is that this particular test showed the Athey metal weather strip to give the least leakage of any of those under investigation. The letter reviews the correspondence on the subject, both with the architects and with the American Society of Heating and Ventilating Engineers, before which the original report of the architects was presented. The Athey test which the company quotes shows the following results:

Wind Velocity Per Hour	Elsewhere leakage cu. ft.	With weatherstrip cu. ft.	Without weatherstrip cu. ft.
Normal wind, 15 miles.....	0.03	0.08	0.75
High wind, 33 miles.....	0.04	0.15	1.42
Storm, 45 miles.....	0.07	0.29	2.88
Great storm, 65 miles.....	0.10	0.54	5.65
Hurricane, 75 miles.....	0.15	0.80	8.45

PEERLESS WATER-TUBE BOILERS for steam, vapor, vacuum and water, are presented in a folder issued by the Peerless Heater Co., Pittsburgh, Pa. The bulletin emphasizes the fact that the company has a boiler for every size and type of installation. Cross-sectional views of the heaters with detailed descriptions make their construction features stand out very clearly.

PECCO DIRECT-FIRED HEATING SYSTEMS is the subject of a catalogue issued by Pecco, Inc., St. Louis, Mo. In this catalogue are shown some representative installation photgraphs made in plants where Pecco heaters are now in use. These heaters are designed for buildings of large cubic contents, where steam is not available. They are made in single units, combining furnace, radiator, fan and casing into a compact heater. Another catalogue issued by this company is devoted to the Pecco steam heater in which the heating element is a series of steam pipe coils, the air being driven through the heater by a multi blade fan. Size of each catalogue 7¾ 9¾ in. Pp., 8 each.

LA BOUR VACUUM HEATING Pump is the subject of Bulletin No. 25, issued by the La Bour Co., Chicago Heights, Ill. This pump is described as a compact, efficient, single pump unit for producing vacuum and removing water and gas from steam heating return lines. The heart of the La Bour vacuum heating return unit is said to be the Centrifugal-Eductor wet vacuum pump. In principle of operation this pump utilizes the velocity of expulsion of small pockets of water and is not dependent upon close clearances in the moving parts, the use of sealing rings or other similar devices. In addition to the pump with its driving unit, the essential equipment consists of two rust-resisting iron tanks placed one above the other; two diaphragm-operated, balanced-type control valves, an easily cleaned suction strainer; two check valves and one special air-relief valve. The point is made in the bulletin that the returns from the heating system contain not only water but also no condensable gases and steam, mostly steam, which under sufficient pressure may be condensed to water and in this way require a materially smaller air pump capacity. In the design of the La Bour pump, the water, gases and steam enter the pump under vacuum and without separation. During the passage through the pump impeller, the fluids pass from a vacuum condition to a condition of pressure equal to that against which the pump is operating. In this way it is stated the flash steam is recondensed to water, so that the pump delivers no steam but only water and gas.

OFFICIAL BULLETIN OF THE HEATING AND PIPING CONTRACTORS NATIONAL ASSOCIATION for January, 1925, contains, among other things, an article on "Home Heating as a Public Service" by President Frank A. Merrill and one on "Management and the Heating Contractor" by Herbert A. Snow, chairman of the association's membership committee.

New York State Heating Contractors' Annual Meeting

Heating and piping contractors New York State Association meet in Buffalo, N. Y., January 5, 1925, for its thirtieth annual convention.

Among the subjects discussed were methods of estimating labor on contracts, individual and co-operative advertising in newspapers, magazines, by direct mail and by sign board, certified heating and the new heating inspection service which Brooklyn contractors are offering the public.

The representative of Contract Bonding Companies, C. W. Sisk, gave a talk upon the difficulties and shortcomings of bonding companies, manufacturers, jobbers and contractors in the heating industry. He was followed by R. Flershem, of the American Radiator Company, who addressed the meeting on the "Business Outlook for 1925 and What We Can Do To Improve It."

Members of the New York State Association were urged to file with national headquarters, copies of the labor agreements made by them.

Following are the newly-elected officers: President, Paul W. Schneider, Utica; vice president, William G. Fraser, Buffalo; secretary-treasurer, William J. Olvany, New York. Board of directors: Fred J. Weider, Rochester; Edward B. Folley, Binghamton; Robert B. Miller, New York, and Martin W. Utz, Rochester. Fred J. Weider was elected chairman of the board, William G. Fraser, vice-chairman, and Henry B. Gombers, recording secretary.

Deaths

GEORGE C. WHIPPLE, consulting engineer and professor of sanitary engineering at Harvard University, died of angina pectoris November 27, at Cambridge, Mass. He was 58 years old. For the last twenty years Professor Whipple was a member of the firm of Hazen and Whipple, consulting civil engineers, New York.

He was a graduate of the Massachusetts Institute of Technology, a director of the Mount Prospect Laboratory and was also chairman of the Hoover Sub-Committee on Plumbing and at one time chief of the Department of Sanitation for the League of Red Cross Societies.

CHARLES A. ALLEN, for the past thirty years New York manager for the American Steam Gauge and Valve Mfg. Co., Boston, Mass., and well known in the machinery and supply field, passed away at his home in Brooklyn, N. Y. December 24, 1924, in his 69th year.

GORDON H. EISENHART, assistant at the A. S. H. & V. E. Research Laboratory, Pittsburgh, Pa., died November 23, 1924. Mr. Eisenhart, who at the time of his death was a senior at the Carnegie Institute of Technology, had assisted in a number of the investigations at the Research Laboratory, notably on the flow of steam in pipes,

for 24 years

SAUNDERS SCHOOL, OMAHA, NEB.
John Latenser, *Architect*

"Repairs have been trifling"

A temperature control system that needs annual adjustment and frequent repairs is next to useless.

DURABILITY and accuracy of control—constantly—are of utmost consequence. To assure these factors to its patrons, the Powers system must of necessity cost more than others which are an annual source of income to their makers. But the premium on first cost of a Powers system is quickly absorbed in freedom from annoyance, in certainty of correct operation, in accuracy of even control of temperature, and in absence of repair bills.

High First Cost Cheapest in the end

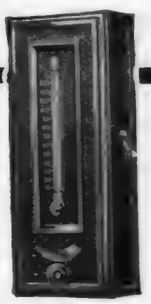
The reason for the remarkable accuracy and Durability of the Powers system of temperature control lies in its famous Vapor Disc Thermostat. It is extremely simple—has no moving parts to get out of order—the intense heat of summer and occasional chill of unheated rooms in winter cause no error in its adjustment.

BOARD OF EDUCATION
SCHOOL DISTRICT OF OMAHA
D. FINLAYSON, SUPT. OF BUILDINGS
2024 NICHOLAS ST. PHONE WEBSTER 5821
OMAHA, NEBR.

Powers Regulator Co.
407 E. 13th St., Kansas City, Mo.
Gentlemen:

Answering your inquiry will say that the Powers System of regulation installed in the Saunders School Building in 1900 is still in operation and doing good work. The repairs required have been trifling in this as well as in other buildings of ours which have your system.

Yours truly,
D. FINDLAYSON,
Supt. of Bldgs.



Our book, THE ELIMINATION OF HEAT WASTE, shows how and why the Powers system of temperature control gives such remarkably long and accurate service, and why its high first cost is cheapest in the end. We shall be glad to send you a copy.

THE POWERS REGULATOR COMPANY

34 years of specialization in temperature control

2718 Greenview Avenue, Chicago

Atlanta, Baltimore, Boston, Buffalo, Butte, Mont., Charlotte, N. C., Cincinnati, Cleveland, Denver, Des Moines, Detroit, El Paso, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, Nashville, New Orleans, New York, Philadelphia, Pittsburgh, Rochester, St. Louis, San Francisco, Seattle

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1019

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

BOILER CAPACITIES FOR DIRECT RADIATION

Compiled by the Chicago Master Steam Fitter's Association and Adopted as Standard, 1923

RULES FOR COMPUTING BOILER SIZES FOR DIRECT RADIATION

Schedule for computing minimum sizes of boilers for the average building based on approved ratings specified in the manufacturer's catalogue.

First reduce all radiation to the equivalent of cast-iron column radiation, then use boiler chart showing factors of safety when buildings are heated to — 10° to 70° F.

Steel tubular or steel water-tube boilers 100 sq. ft. per horse power (A.S.M.E. code).

In computing boiler sizes for buildings heated to lower than — 10° to 70° F., multiply the amount of cast-iron column radiation necessary to maintain the required temperature by the following coefficient before adding the percentage given in rule for computing boiler sizes.

	Steam	Water
—10° to 65° F	1.03	1.05
—10° to 60°	1.07	1.09
—10° to 55°	1.10	1.13
—10° to 50°	1.13	1.18
—10° to 45°	1.17	1.24
—10° to 40°	1.20	1.27

RULES FOR COMPUTING BOILER SIZES FOR DIRECT-INDIRECT AND INDIRECT RADIATION

For computing boiler size for direct-indirect and indirect radiation, reduce same to basis of direct by adding 25% to direct-indirect and 50% to indirect, then use factor of safety as called for on direct radiation.

RULES FOR COMPUTING BOILER SIZES FOR FAN-BLAST COILS

For computing boiler size to be used for Fan-Blast Coils use manufacturers' condensation charts and figure ¼ lb. of condensation per hour as equivalent to 1 sq. ft. of direct radiation and add factor of safety: See "X," in table on Data Sheet No. 49-E.

When water for domestic use is heated by heating boiler, size of boiler should be increased, figuring each gallon of water tank capacity as equivalent to 2 sq. ft. of steam radiation or 3.2 sq. ft. of water radiation.

For example, a 160-gal. tank should be figured as equivalent to 320 sq. ft. of steam radiation or 512 sq. ft. of water radiation, plus factor of safety as indicated on boiler chart showing factors of safety.

Continued on Data Sheet No. 49-C revised

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900
1		135	134	134	133	133	133	132	132	131	131	130	130	130	129	129	128	128	127	127	127	126	126	125	125	125	124	124	123	123	122
2		130	129	129	128	128	128	127	127	126	126	125	125	125	124	124	123	123	122	122	122	121	121	120	120	120	119	119	118	118	117
3		125	124	124	123	123	123	122	122	121	121	120	120	120	119	119	118	118	117	117	117	116	116	115	115	115	114	114	113	113	112
4		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
5		100	.995	.99	.985	.983	.98	.975	.97	.965	.963	.958	.953	.95	.945	.94	.938	.933	.928	.925	.92	.915	.913	.908	.903	.90	.895	.89	.887	.883	.878
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.80	.798	.796	.794	.79	.785	.783	.779	.775	.773	.77	.768	.763	.76	.758	.753	.75	.748	.745	.743	.738	.735	.733	.729	.725	.723	.72	.717	.713	.71
8		.75	.745	.74	.735	.73	.725	.72	.715	.71	.705	.70	.695	.69	.685	.68	.675	.67	.665	.66	.655	.65	.645	.64	.635	.63	.625	.62	.615	.61	.605
9		.65	.645	.64	.635	.63	.625	.62	.615	.61	.605	.60	.595	.59	.585	.58	.575	.57	.565	.56	.555	.55	.545	.54	.535	.53	.525	.52	.515	.51	.505
10		.50	.498	.495	.493	.49	.488	.485	.483	.48	.478	.475	.473	.47	.468	.465	.463	.46	.458	.453	.45	.448	.443	.44	.438	.435	.433	.43	.428	.425	.423
11		.45	.448	.445	.443	.44	.438	.435	.433	.43	.428	.425	.423	.42	.418	.415	.413	.41	.408	.403	.40	.398	.393	.39	.388	.385	.383	.38	.378	.375	.373
12		.40	.398	.397	.395	.394	.393	.391	.39	.388	.387	.385	.384	.383	.381	.38	.378	.377	.375	.374	.373	.37	.368	.367	.365	.364	.363	.361	.36	.358	.357
13		.35	.348	.347	.345	.344	.343	.341	.34	.338	.337	.335	.334	.333	.331	.33	.328	.327	.325	.324	.323	.32	.318	.317	.315	.314	.313	.311	.31	.308	.307
14		.30	.298	.297	.295	.294	.293	.291	.29	.288	.287	.285	.284	.283	.281	.28	.278	.277	.275	.274	.273	.27	.268	.267	.265	.264	.263	.261	.26	.258	.257

Boilers—Boiler Capacities | No. 49-B (revised)

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

BOILER CAPACITIES FOR DIRECT RADIATION

Continued from Data Sheet No. 49-B revised

It is recommended that in all installations of steam boilers that drain valves be placed on the returns and that the condensation from such returns be discharged into the sewer for a period of from three days to one week after starting fire, thereby clearing system of grease and dirt. At the end of this period boiler should be thoroughly washed and blown out.

EXAMPLE

Find size of steel down-draft brick-set boilers required for the following installation (Key No. 14, Boiler Chart) Data Sheet No. 49-B (revised):

(1) 500 sq. ft. of direct cast-iron column radiation in rooms to be heated from—10° to 70° F.
(2) 500 sq. ft. of direct cast-iron column radiation in rooms to be heated from—10° to 50° F.
(3) 500 sq. ft. of cast-iron wall radiation or wall pipe coils (being the equivalent of 625 sq. ft. of cast-iron column radiation) in rooms to be heated from—10° to 50° F.
(4) 500 sq. ft. of indirect radiation.
(5) 500 sq. ft. of direct-indirect radiation.
(6) 250 gal. hot water tank. Water to be heated with steam coils.
(7) 500 sq. ft. of cast-iron fan blast radiation, regular sections, 5-in. centers, 1,000 ft. velocity, air taken from out of doors—10° to F.T. 80. Radiation three stacks deep.

ANSWER

(1)	500 sq. ft.	500
(2)	500 sq. ft. 13%	565
(3)	500 sq. ft. 25% 13%	707
(4)	500 sq. ft. 50%	750
(5)	500 sq. ft. 25%	625
(6)	250 gal. × 2	500
		3647
	Add factor of safety 0.261	952
		4598
(7)	500 x 1.92 x 4 10%	4224
	Minimum rated capacity of boilers	8822

Continued on Data Sheet No. 49-D

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900
1		122	122	121	121	120	120	120	119	119	118	118	117	117	117	116	116	115	115	114	114	114	113	113	112	112	112	111	111	110	110
2		117	117	116	116	115	115	115	114	114	113	113	112	112	112	111	111	110	110	109	109	109	108	108	107	107	107	106	106	105	105
3		112	112	111	111	110	110	110	109	109	108	108	107	107	107	106	106	105	105	104	104	104	103	103	102	102	102	101	101	100	100
4		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
5		.875	.87	.865	.863	.858	.855	.85	.845	.84	.837	.832	.828	.825	.82	.815	.81	.808	.803	.798	.795	.79	.787	.783	.778	.773	.77	.765	.76	.758	.753
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.707	.703	.70	.698	.694	.691	.688	.685	.682	.678	.675	.673	.669	.665	.663	.659	.657	.655	.65	.648	.643	.64	.638	.634	.63	.628	.625	.623	.619	.615
8		.60	.598	.596	.595	.593	.592	.59	.588	.587	.586	.585	.583	.581	.58	.579	.577	.575	.574	.573	.571	.57	.568	.566	.565	.564	.562	.56	.559	.558	.555
9		.50	.498	.496	.495	.493	.492	.49	.488	.487	.486	.485	.483	.481	.48	.479	.477	.475	.474	.473	.471	.47	.468	.466	.465	.464	.462	.46	.459	.458	.455
10		.42	.418	.415	.413	.41	.408	.405	.403	.40	.398	.395	.393	.39	.388	.385	.383	.38	.378	.375	.373	.37	.368	.365	.363	.36	.358	.355	.353	.35	.348
11		.37	.368	.365	.363	.35	.358	.355	.353	.35	.348	.345	.343	.34	.338	.335	.333	.33	.328	.325	.323	.32	.318	.315	.313	.31	.308	.305	.303	.30	.298
12		.355	.354	.353	.351	.35	.348	.347	.345	.343	.341	.34	.338	.337	.335	.334	.333	.331	.33	.328	.327	.325	.324	.323	.321	.32	.318	.317	.315	.314	.313
13		.305	.304	.303	.301	.30	.298	.297	.295	.293	.291	.29	.288	.287	.285	.284	.283	.281	.28	.278	.277	.275	.274	.273	.271	.27	.268	.267	.265	.264	.263
14		.255	.254	.253	.251	.25	.248	.247	.245	.243	.241	.24	.238	.237	.235	.234	.233	.231	.23	.228	.227	.225	.224	.223	.221	.22	.218	.217	.215	.214	.213

NOTE—No boiler to be installed having grate longer than 72".

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

BOILER CAPACITIES FOR DIRECT RADIATION

Key For Computing Boiler Sizes

Continued from Data Sheet No. 49-C (revised)

Key	Manufacturer	Trade Name	Catalogue
3	American Radiator Company	Arco Round	April 1, 1922
5	American Radiator Company	Ideal Sectional	April 1, 1922
5	American Radiator Company	Type "T," 23", 29," 36", 48", with't arch	April 1, 1922
7	American Radiator Company	Type "T," 23", 29", 36", 48", with arch	April 1, 1922
7	American Radiator Company	Type "T," 79"	August, 1923
6	American Radiator Company	Type "A"	April 1, 1922
0	Burnham Boiler Corporation	Round, 150% on all sizes	No. 62
5	Burnham Boiler Corporation	Square Sectional	No. 62
5	Continental Heater Corporation	Cont-Bernhard Up-draft	
5	Continental Heater Corporation	Cont-Bernhard Smokeless	
5	Cox Abram Stove Co	Novelty Round	No. 76A
5	Cox Abram Stove Co	Novelty Square	No. 76A
5	Cox Abram Stove Co	Novelty Smokeless	No. 76A
5	Harrisburg Star Boiler Co	Harrisburg Star Water Tube	
5	Hart & Crouse Co	Royal Round Boiler	
5	Hart & Crouse Co	Royal Sectional Boiler	
5	Hart & Crouse Co	Royal Header Type	
3	Hart & Crouse Co	H. & C. Down-draft Series, 24"	
10	Hart & Crouse Co	H. & C. Down-draft Series, 33–40–55" NOTE.—Series 24–33–40–55", ratings are 4 times pounds of condensation as shown in Catalog No. 4723.	
5	Herbert Boiler Co	Junior all steel boiler	1923
7	Herbert Boiler Co	Portable down draft	1923
7	Herbert Boiler Co	Portable direct draft	1923
10	Herbert Boiler Co	Brick-set down draft	1923
12	Herbert Boiler Co	B Series	1923
5	Ideal Furnace Co	Radiant Round Boiler	
5	Ideal Furnace Co	Radiant Square Boiler	
7	Ideal Furnace Co	Radiant Smokeless Boiler	
5	Illinois Malleable Iron Co	Imico Illinois Round	1916
5	Illinois Malleable Iron Co	Imico Sectional	1916
7	Illinois Malleable Iron Co	Imico Smokeless	1916
3	International Heater Co	Economy Round Boiler	1922
5	International Heater Co	Economy Sectional Boiler	1922
5	International Heater Co	Economy Smokeless Boiler	1923
3	Kellogg-Mackay Co	Pebco Round	
5	Kellogg-Mackay Co	American Up-draft	
7	Kellogg-Mackay Co	American Smokeless	
8	Kellogg-Mackay Co	Pierce Magazine	
14	Kewanee Boiler Co	Smokeless Portable	Cat. 78
14	Kewanee Boiler Co	Smokeless Brick-set	Cat. 78
14	Kewanee Boiler Co	Smokeless Type K	Cat. 78
14	Kewanee Boiler Co	Portable Up-draft	Cat. 78
14	Kewanee Boiler Co	Brick-set Up-draft	Cat. 78
14	Kewanee Boiler Co	Type K Up-draft	Cat. 78
1	Mueller L. G. Furnace Co	Mueller Round	1922
5	Mueller L. G. Furnace Co	Mueller Sectional	1922
1	Monroe Fdry. & Furnace Co	Floral City Boiler	Cat. 26
0	National Radiator Co	Acme Round Boiler, 150% on all sizes	No. 32

Concluded on Data Sheet No. 49-E

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9200	9400	9600	9800	10000	10200	10400	10600	10800
1		110	109	109	108	108	107	107	107	106	106	105	105	104	104	104	103	103	102	102	101	101	101	100	100	997	993	99	988	986	985
2		105	104	104	103	103	102	102	102	101	101	100	100	999	993	99	985	98	975	973	969	965	96	955	95	947	943	94	938	936	935
3		100	995	99	98	98	978	973	97	965	96	955	951	949	943	94	935	93	925	923	919	915	91	905	90	897	893	89	888	886	885
4		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
5		.75	.745	.74	.735	.73	.728	.723	.72	.715	.71	.705	.701	.699	.693	.69	.685	.68	.675	.673	.669	.665	.66	.655	.65	.647	.643	.64	.638	.636	.635
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.613	.608	.606	.603	.60	.596	.593	.59	.586	.583	.58	.578	.574	.57	.568	.563	.561	.558	.555	.551	.548	.545	.542	.539	.536	.533	.531	.53	.528	.526
8		.554	.552	.55	.549	.548	.547	.546	.545	.543	.541	.54	.538	.536	.535	.533	.531	.53	.529	.527	.525	.524	.523	.52	.519	.517	.516	.515	.515	.514	.513
9		.454	.452	.45	.449	.448	.447	.446	.445	.443	.441	.44	.438	.436	.435	.433	.431	.43	.429	.427	.425	.424	.423	.42	.419	.417	.38	.375	.37	.365	.36
10		.345	.343	.34	.338	.335	.333	.33	.328	.325	.323	.32	.318	.315	.313	.31	.305	.30	.298	.295	.293	.29	.289	.288	.286	.285	.278	.276	.275	.274	.273
11		.295	.293	.29	.288	.285	.283	.28	.278	.275	.273	.27	.268	.265	.263	.26	.255	.25	.248	.245	.243	.24	.239	.238	.236	.235	.228	.226	.225	.224	.223
12		.306	.304	.303	.301	.299	.298	.296	.295	.293	.292	.29	.289	.287	.285	.283	.282	.28	.279	.277	.275	.274	.273	.271	.27	.269	.266	.265	.264	.264	.263
13		.256	.254	.253	.251	.249	.248	.246	.245	.243	.242	.24	.239	.237	.235	.233	.232	.23	.229	.227	.225	.224	.223	.221	.22	.219	.216	.215	.214	.214	.213
14		.206	.204	.203	.201	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

BOILER CAPACITIES FOR DIRECT RADIATION

Key for Computing Boiler Sizes (cont'd)

Continued from Data Sheet No. 49-D

Key	Manufacturer	Trade Name	Catalogue
3	National Radiator Co.	Novus Boiler	No. 32
5	National Radiator Co.	National Up-draft	No. 32
5	National Radiator Co.	National Smokeless	No. 32
8	Newport Boiler Co.	Newport Magazine	1920
3	Niagara Rad. & Boiler Co.	Niagara 1920 Round	
7	Niagara Rad. & Boiler Co.	Niagara Smokeless	1922
14	Oil City Boiler Works.	Smokeless Portable	No. 9
14	Oil City Boiler Works.	Smokeless Brick-set	No. 9
14	Oil City Boiler Works.	Direct Draft Portable	No. 9
14	Oil City Boiler Works.	Direct Draft Brick-set	No. 9
9	Pacific Boiler Sales Corp.	Pacific Smokeless	S. C. 23
10	Pacific Boiler Sales Corp.	Pacific Direct Draft	S. C. 23
9	Pacific Boiler Sales Corp.	Pacific Down Draft	S. C. 23
1	Page, Wm. H., Boiler Co.	Volunteer Round	Cat. 50
5	Page, Wm. H., Boiler Co.	Monarch Square Up-draft Smokeless	Cat. 50
5	Page, Wm. H., Boiler Co.	Monarch Square Sectional	Cat. 50
5	Page, Wm. H., Boiler Co.	Monarch Square Down-draft	Cat. 50
3	Peerless Heater Co.	Peerless Round	1923
5	Peerless Heater Co.	Peerless Sectional Up-draft	1923
5	Peerless Heater Co.	Peerless Smokeless	1923
5	Richardson & Boynton Co.	Round Boiler	No. 203
5	Richardson & Boynton Co.	Sectional Up-draft	No. 203
7	Richardson & Boynton Co.	Smokeless Boiler	1922
2	Richmond Radiator Co.	Riraco Boiler	No. 100
2	Richmond Radiator Co.	Round Boiler	No. 100
5	Richmond Radiator Co.	Sectional Up-draft	No. 100
5	Richmond Radiator Co.	Model Boiler	No. 100
8	Richmond Radiator Co.	Magazine Smokeless	No. 100
9	Ross Boiler Co.	Portable	
12	Simplex Boiler Co.	Portable Smokeless	
8	Standard Water Co.	Spencer Magazine Boiler	No. 18
5	Thatcher Furnace Co.	Round Boiler	1923
5	Thatcher Furnace Co.	Sectional Boiler	1923
5	Thatcher Furnace Co.	Progress Boiler	1923
14	Titusville Iron Wks. Co.	Perfection Smokeless	Cat. 81
14	Titusville Iron Wks. Co.	Tico Smokeless	Cat. 81
14	Titusville Iron Wks. Co.	Acme Smokeless	Cat. 81
14	Titusville Iron Wks. Co.	Perfection Up-draft	Cat. 81
14	Titusville Iron Wks. Co.	Tico Up-draft	Cat. 81
14	Titusville Iron Wks. Co.	Acme Up-draft	Cat. 81
1	Union Radiator Co.	Union Round	
5	Union Radiator Co.	Square Sectional	
2	United States Rad. Corp.	Capitol Winchester	1922
5	United States Rad. Corp.	Capitol Sectional	1922
5	United States Rad. Corp.	Semi-Smokeless	1922
7	United States Rad. Corp.	Capitol Smokeless	1922
5	Utica Heater Co.	Square Up-draft	
7	Utica Heater Co.	Imperial Smokeless	
1	Weil-McLain Co.	Round Boiler	1923
5	Weil-McLain Co.	Sectional Up-draft	1923
7	Weil-McLain Co.	Smokeless	1923
5	All Artificial Gas-Fired Boilers		

Note: No change in boiler factors will be made by installing oil burners.

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	11000	11200	11400	11600	11800	12000	12200	12400	12600	12800	13000	13200	13400	13600	13800	14000 & Over	X
1		983	98	978	975	973	971	97	968	965	963	962	958	956	955	953	95	95	50%
2		933	93	928	925	923	921	92	918	915	913	912	908	906	905	903	90	90	50%
3		833	88	878	875	873	871	87	868	865	863	862	858	856	855	853	85	85	50%
4		.92	92	92	92	92	.92	92	92	92	92	92	92	92	.92	.92	.92	.92	50%
5		.633	.63	.628	.625	.623	.621	.62	.618	.615	.613	.612	.608	.606	.605	.603	.60	.60	40%
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	40%
7		.525	.523	.522	.52	.518	.516	.515	.513	.512	.51	.508	.507	.506	.505	.503	.50	.50	25%
8		.512	.512	.511	.51	.509	.508	.507	.506	.505	.505	.504	.503	.503	.502	.501	.50	.50	25%
9		.355	.35	.345	.30	.30	.29	.264	.261	.26	.259	.258	.256	.255	.253	.251	.25	.25	15%
10		.27	.269	.268	.267	.266	.265	.264	.261	.26	.259	.258	.256	.255	.253	.251	.25	.25	15%
11		.22	.219	.218	.217	.216	.215	.214	.211	.21	.209	.208	.206	.205	.203	.201	.20	.20	15%
12		.262	.261	.26	.26	.259	.258	.257	.256	.256	.255	.255	.254	.253	.252	.251	.25	.25	15%
13		.212	.211	.21	.21	.209	.208	.207	.206	.206	.205	.205	.204	.203	.202	.201	.20	.20	10%
14		.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	10%

NOTE—No boiler to be installed having grate longer than 72".

Boilers—Boiler Capacities | No. 49-E

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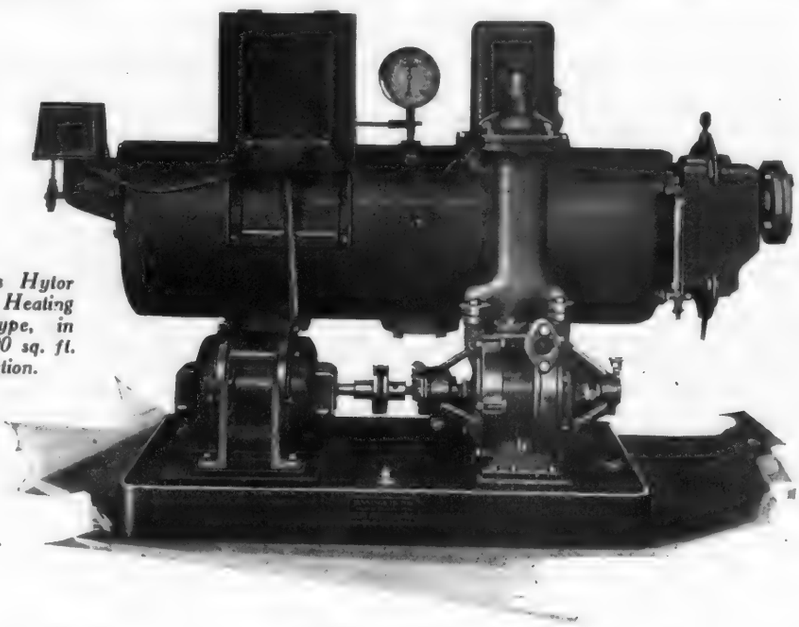
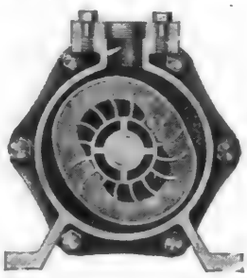


Motor-Driven Jennings Hytor Return Line Vacuum Heating Pump, Manifold Type, in capacities up to 300,000 sq. ft. equivalent direct radiation.

Jennings Hytor Vacuum Pump, Manifold Type



The rotor, consisting of a cylindrical hub, around the periphery of which are chambers or spaces, revolves freely in an elliptical casing filled with water.

As the rotor turns, the water is compelled by centrifugal force to follow the contour of the casing and alternately to enter and to leave the rotor chambers, twice in each revolution.

When the water recedes from the rotor, air is drawn into the chambers through the inlet port. As the water is then alternately forced back into the rotor chambers by the converging casing, the air is compressed and is discharged from the rotor through the outlet port.

Like all other Jennings Hytors for return line vacuum heating systems, the Manifold Type is quiet in operation, effects a worth-while saving in motor horsepower, and occupies only a fraction of the space required by reciprocating equipment of equivalent capacity.

There are but two moving parts, the pump impellers. All complications are eliminated. No air separating devices or water legs are required, since the condensation is discharged directly into the boiler.

The air vent from the centrifugal water unit, as well as the air inlet to, and the air discharge from the air unit, are encased in a single manifold, from which the Manifold Type Hytor derives its name.

Control may be either for automatic or continuous operation. Reliability and satisfactory performance are assured.

NASH ENGINEERING COMPANY

So. Norwalk Connecticut

Branch Sales Offices in *Atlanta, Boston, Buffalo, Chicago, Cleveland, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle and Washington, D. C.*
In Canada—*Montreal, Toronto and Vancouver.*

Jennings Hytor

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Coming Events

April 15-16, 1925.—Annual convention of National Warm Air Heating and Ventilating Association, at Cleveland, O. Headquarters at the Hollenden Hotel.

May 19–22, 1925.—Sixteenth annual convention of the National District Heating Association at West Baden, Ind. Headquarters at West Baden Hotel.

June 1-4, 1925.—Thirty-sixth annual convention of the Heating and Piping Contractors National Association at Detroit, Mich. Headquarters at the new Book-Cadillac **Hotel.**

Miscellaneous Notes

National Industrial Conference Board, 247 Park Ave., New York, reports that rents paid by wage earners for houses of four or five unheated rooms and a bath, in the United States as a whole, averaged 84% higher in November, 1924, than they did in the summer of 1914. Rents of such houses reached a peak in July, 1924, between which date and November they decreased 1.1%, leaving, however, a net increase of 2.2% for the twelve months ending November, 1924.

National District Heating Association will hold its sixteenth annual convention at the West Baden Springs Hotel, West Baden, Ind., Tuesday, Wednesday, Thursday and Friday, May 19 to 22, 1925.

National Distribution Conference was held in Washington, January 14 and 15, under the auspices of the Chamber of Commerce of the United States. This conference, including 37 trade groups covered, virtually, the entire field of merchandising and distribution. Six avenues of approach to the study of the general problem of distribution and its effect upon retail prices were discussed. These are: The collection of business statistics as a means toward the accomplishment of economies in distribution; the regulation and improvement of trade relations; advertising and advertising mediums; expenses of doing business; methods of distribution; general conditions affecting distribution.

National Safety Council held its annual Mid-West Safety Conference in the Hotel LaSalle, Chicago, January 19. One of the principal subjects discussed was fire protection. A series of five-minute talks was also given on safety kinks, safety equipment and educational stunts, illustrated with exhibits and slides.

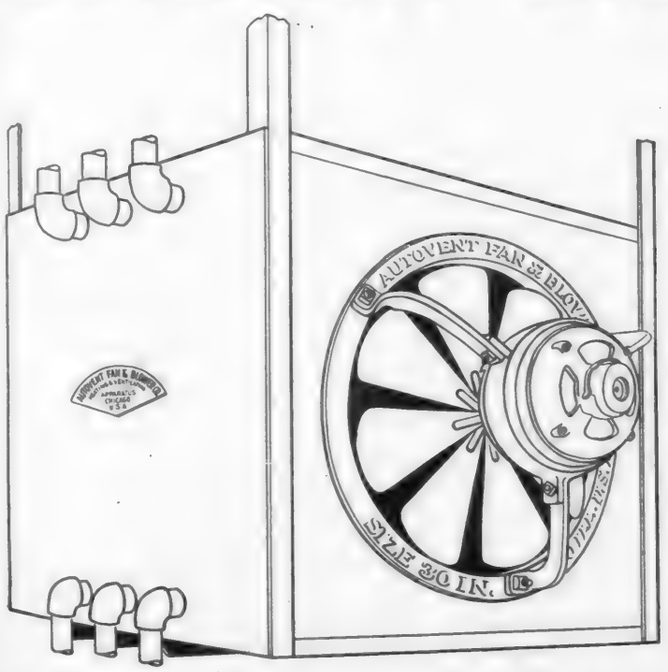
American Engineering Standards Committee held its annual meeting in New York December 11. Charles E. Skinner, a representative of the American Institute of Electrical Engineers, was elected chairman for the year 1925 and Charles R. Hart, representative of the American Railway Association, was elected vice-chairman.

American Public Health Association announces its affiliation with the American Association for the Advancement of Science. It now has representation in the council of the A. A. A. S. and thus may take part in directing the affairs of the latter. No financial obligations are involved on either side.

Associated General Contractors held its annual meeting in Washington, D. C. January 12 to 15, 1925.

Harvard University Business School announces the selection of McKim, Mead and White, of New York, as architects for its new group of buildings, to be erected under the George F. Baker Foundation. The award was made on a competitive basis. With the selection of the architect, work on the

AUTOVENT UNIT HEATERS



These efficient heating units are constructed for both floor and ceiling installation. The ceiling type shown on left, can be employed where floor space is not available.

Send for copy of Engineers Data Book and Bulletin 65—then compare Autovent Unit Heaters with any similar type on the market.

ACTIVE SALES OFFICES AND BRANCHES IN ALL PRINCIPAL CITIES

AUTOVENT FAN & BLOWER CO.
730-738 W. MONROE ST. - CHICAGO

actual plans for the new building will be pushed forward as rapidly as possible.

Chicago Oil Burner Association has been formed in Chicago, Ill., comprising manufacturers and distributors. The purpose of the organization is to promote interest in efficient oil burning. Officers of the new organization are: S. O. Andros, editor *The Home Comfortable*, president; Charles H. Crooks, Aladdin Oil Burner Co., first vice-president; Linn T. Piper, the Oil Heating Co., second vice-president; and H. N. Rosenheim, of the A. B. C. Oil Burner Co., third vice-president; T. C. Kyle, Winslow Boiler & Engineering Co., secretary-treasurer.

New York Board of Standards and Appeals has approved the Universal oil burner, manufactured by the Universal Oil Burner Corporation, also the Leiman oil pump, manufactured by Leiman Bros., New York.

Leipzig, Germany.—The Leipzig Fair, which is described as the largest exhibit of its kind in the world, will be held in two sections, the first opening the first Sunday in March and the second, the last Sunday in August, each lasting a week. Included in the exhibition will be a general samples fair and a technical fair, together with a building trades Fair. Fifteen thousand exhibits will be shown. The organization and management of the Fair is in the hands of the "Messant Fur Die Mustermessen" Market 4, Leipzig, from which all information can be obtained.

George Hall Morris, formerly partner in the firm of Johnson & Morris, prominent heating contractors of New York City, was honored by the members of the Heating and Piping Contractors New York City Association, at a recent dinner held at the rooms of the Building Trades Employers' Association. Members of the board of directors of the National Association were present as the guests of the New York City Association. Mr. Morris recently retired after 43 years of service in the building industry. The Building Trades Employers' Association of New York City has also shown its appreciation of the work done by Mr. Morris by making him an honorary member of that body.

American Association of Oil Burner Manufacturers will hold its second annual convention in Chicago, Ill., April 1, 2 and 3, at the Edgewater Hotel. An exposition will be held in connection with this convention, at which many manufacturers are expected to display their lines.

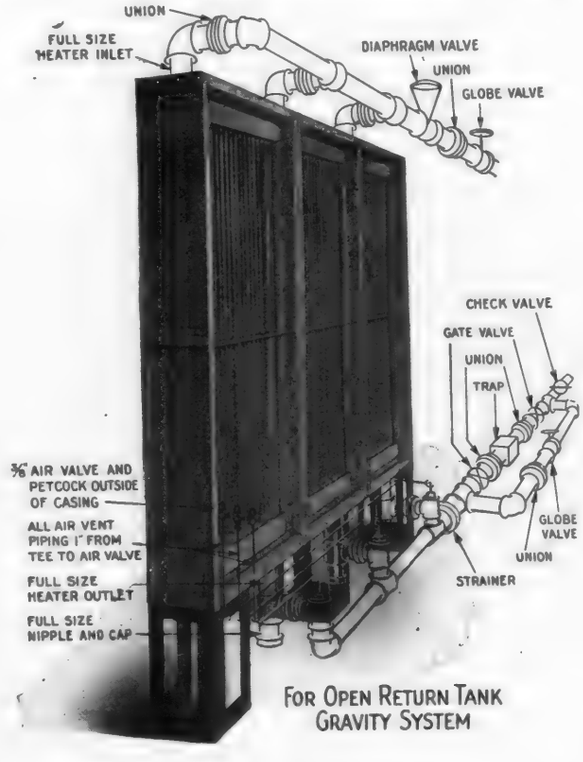
National Distribution Conference, held January 14 and 15, at the United States Chamber of Commerce, Washington, D. C. for the study of problems of distribution had more than two hundred delegates, including business men, economists and government officials in attendance. Secretary of Commerce Herbert Hoover called attention to the source of waste and the formidableness of the task confronting the conference. The two-days' session was given over entirely to the discussion of the method of approaching the problem and the organization of committees to carry on the work. The field was divided into six sections each of which will be covered by a special composite committee.

Engineering Advertisers Association, Chicago, Ill., which has been making a survey of the manufacturing prospects for 1925, reports that the average production expected for the first six months of 1925 as compared with the average for the twelve months of 1924, average production expected for the second six months in 1925, as compared with the first six months, is 103.9% or an increase of 3.9%. The number of plants reporting was 1,116 with a total horsepower of 1,966,590.

Manufacturers Notes

Hoffman Specialty Co., Inc., Waterbury, Conn., announces a 30% increase in business for the year 1924 over the preceding year.

Anchor Stove and Range Co., New Albany, Ind., held its sales convention January 5, 6, and 7. At their meeting plans were rounded out for marketing the company's new cabinet heater which has the appearance of a music cabinet of Queen Anne period design.



FOR OPEN RETURN TANK GRAVITY SYSTEM

AEROFIN CORPORATION
750 Frelinghuysen Avenue
Newark, N.J.
L. C. Soule, *Sec'y and Chief Engineer*

AEROFIN
Fan-System Heating Surface

TO ENGINEERS AND ARCHITECTS:

Aerofin Saves Space and Weight.

The light weight and non-corrosive features of Aerofin, together with its unit construction, space saving and because it comes to the job already encased and ready for steam connections, demonstrates its superiority, and for this reason we believe Aerofin merits being incorporated in your specifications. SINCE THERE IS NO EQUAL TO AEROFIN, WHY NOT SPECIFY IT OUTRIGHT? At least, we ask you to specify Aerofin as a standard and to figure out the exact sizes and number of units required so that the contractor will know what to figure on.

TO THE CONTRACTOR:

SAVE TEN CENTS PER FOOT OF HEATING SURFACE by erecting the (completely encased) Aerofin Units in the same number of HOURS as you would need DAYS to erect the heavy heaters.

SAVE MORE MONEY with Aerofin on account of the smaller number of steam and return connections required.

DON'T FORGET the saving in freight and cartage.

No extra reinforcement of the building construction required with Aerofin—may be suspended from ceiling with small angles and rods, without expensive platforms—may be handled with only ordinary care and assembled without using any block and tackle or scaffolding.

These features demonstrate that you can really save money by installing Aerofin altho the first cost, f. o. b. factory, may be a trifle higher than that of other fan-system heaters.

Illustration shows the ease with which several units high or wide of Aerofin may be assembled together by simply bolting thru the template punched flanges.

Aerofin Is Sold ONLY by Manufacturers of Nationally Advertised Blower Heating Apparatus.

Johns-Manville Underground System of Insulation

The Trench. This one presented particular difficulties because of many springs and some quicksand.

Laying the underdrain in the sub-trench. One underdrain for each run of conduit.

Centering lower half of conduit after a substantial bed of gravel has been provided.

Setting roll frames in concrete piers. These frames support the piping and permit free movement in expansion.

Welding piping strengthens joints and makes them tight. After welding, pipes are thoroughly tested with water under pressure for leakage.

Tops applied. The lower half of conduit already contains Asbesto-Sponge Conduit Filling. Lower and top halves are mated by number.

Asbesto-Sponge Filler being rammed in between the top and the piping. This insulation is the most efficient of its kind and retains its efficiency longest.

Cementing the bell joints further seals the conduit and makes it completely watertight.

Additional gravel is placed in the trench above the level of the side joints. After backfilling and grading, the system is ready for use.

THE efficiency of the Johns-Manville Underground System of Insulation for steam and hot water pipes is usually well over 90%. Hundreds of installations throughout the United States and Canada have shown the efficiency of this system to be permanent and dependable. Carefully and securely laid, these systems operate for many years with little or no maintenance expense.

JOHNS-MANVILLE INC., 292 MADISON AVENUE AT 41ST STREET, NEW YORK CITY
Branches in 62 Large Cities, For CANADA: CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

Johns-Manville
Trade Mark Registered
Asbestos
and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE

Continental Heater Corp., Dunkirk, N. Y. announces the building of a new addition of 25,000 sq. feet floor space for warehouse purposes. The boiler department is being moved into the new boiler plant, which is 100 ft. x 360 ft. and the entire main plant will be used exclusively for the manufacture of radiators.

Ilg Electric Ventilating Co., Chicago, Ill., reports that sales for the last three months in 1924, total up the best quarter in the company's history, the three months running considerably over half a million. With the business outlook for 1925 at least as good as 1924 and with the increased use of ventilating apparatus for homes, stores and garages, theatres, banks, restaurants, etc. the company looks for the best year in its history.

Scott Valve Mfg. Co., Detroit, Mich. announces that O. L. Chapman has joined its sales organization. Mr. Chapman, who is well-known in the industrial field, will handle the manufacturing plant trade.

Jenkins Bros., New York, announces the appointment of William H. Utz, vice-president and formerly European director of Jenkins Bros., Limited, as director of sales for this company in the United States. Mr. Utz assumed his new position January 1, 1925.

American Radiator Co., New York, has transferred R. M. Stackhouse, from the Kansas City branch to the Cleveland, O., branch in his same capacity as manager.

O-E Specialty Mfg. Co., Milwaukee, Wis., reports that its Tientsin, China, representative, Messrs. J. Twyford & Co., has closed contracts for the installation of "O-E" vapor-vacuum pressure heating systems in three large buildings in Tientsin.

Cleveland Gas Burner Co., Cleveland, O., announces that F. J. Zinke, formerly general manager of Hoffman Heater Co., has been made manager of the Cleveland Gas Burner Company. Harry L. Kern, president of the company, left January 22, for a six weeks' trip to the Pacific Coast.

John J. Nesbitt Inc., Atlantic City, N. J., announces the appointment of the Power Equipment Co., 816-17 Lewis Building, Portland, Ore., and 1,143 Henry Building, Seattle, Wash., as its representative in the two cities named for the sale of Universal unit system of heating and ventilating.

Burnham Boiler Corp., Irvington-on-Hudson, N. Y., announces the appointment of Adna F. Johnson to its sales force with headquarters at Columbus, O. Mr. Johnson is familiar with heating problems, having been a heating contractor. The San Francisco office of this company which was recently opened, is under the management of L. R. Penhallegon, who has been selling Burnham boilers for many years.

A. Harvey's Sons' Mfg. Co., Detroit, Mich., had a sales conference early in January which included a dinner and a theatre party. Business conditions and future possibilities were discussed.

American Oil Heating Corp., West Townsend, Mass., has entered into a sales agreement with the Bethlehem Shipbuilding Corp., Ltd., New York. The latter company secures the exclusive wholesaling rights of the Homer oil burner under this agreement. Exclusive territories are being closed through local heating and plumbing concerns for the marketing of this burner.

Thatcher Co., Newark, N. J., is the new title of the Thatcher Furnace Company. The change, it is stated, is due to the fact that the company has outgrown its name. When the company was incorporated many years ago its only products were Thatcher warm-air furnaces. Later on the company added coal and gas ranges and steam and water boilers to its line. At the present time, the statement continues, the boiler and range production has become the larger end of the business.

Dahlquist Mfg. Co., Boston, Mass., celebrated its twenty-fifth anniversary under the direction of Theodore Dahlquist, president of the company, by placing upon the market the new Dahlquist Aquatherm copper range boiler. This appliance is designed to provide all the conveniences of an instantaneous heater

IN ST. LOUIS SCHOOLS

CLEVELAND HIGH SCHOOL
ST. LOUIS, MO.
E. S. HALLETT, Engineer

A battery of six TYPE E Generators in the above building make possible a saving of thousands of dollars yearly in fuel. Our Bulletin No. 4 will tell you how this can be accomplished in your buildings. Write for it.

Ozone Ventilation—

continues to prove itself a paying investment. Six more St. Louis schools were equipped with our Type E, enclosed equipment this fall—

The Cleveland High School
The Yeatman High School
The Soldan High School
The Walnut Park School
The Lincoln School
The Mann School

Approximately 800,000 C. F. M. are being treated in the above buildings, and about 600,000 C. F. M. recirculated. Imagine the resulting fuel economy!

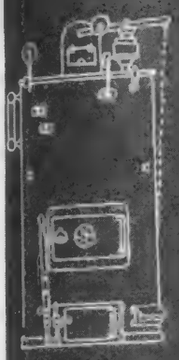
And the ventilation is excellent.

OZONE PURE AIRIFIER COMPANY

1455 W. Congress Street, Chicago

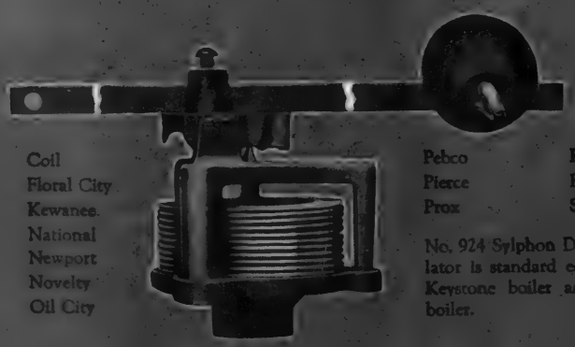
Ozone Ventilation is Economical Ventilation

Standard Equipment On All These Steam Boilers



Coil

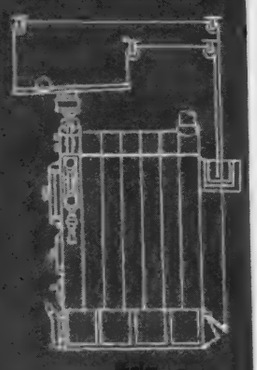
Abco	Coil
Abendroth	Floral City
Ames	Kewanee
Bernhard	National
Birchfield	Newport
Butler	Novelty
Coatesville	Oil City



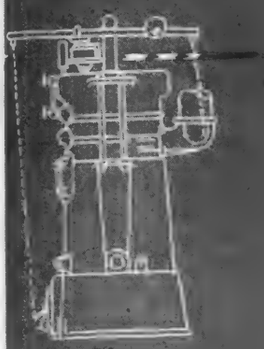
Pebco	Richardson
Pierce	Ross
Prox	Simplex

No. 924 Sylphon Damper Regulator is standard equipment on Keystone boiler and Economy boiler.

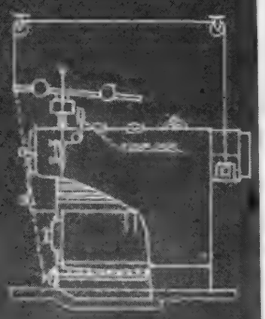
No. 22 Sylphon Damper Regulator for low pressure steam boilers



Butler



Pebco



Simplex

22 Leading Boilers Which Will Not Heat A House Unbearably Or Keep It In "Cold Storage"

THE smooth, definite and *everlasting* action of the Sylphon Damper Regulators on all these leading boilers absolutely insures even heating—no over-heating, no underheating—just comfortable, even temperature throughout the house. From the standpoint of comfort, even heating of homes is desirable; from the standpoint of health, it is imperative.

These boilers give these definite heating results with a minimum of coal consumption too, because Sylphon Damper Regulators feed just the amount of air to coal that each of the boilers require for their economical working.

The secret of the Sylphon accuracy is the Sylphon Bellows

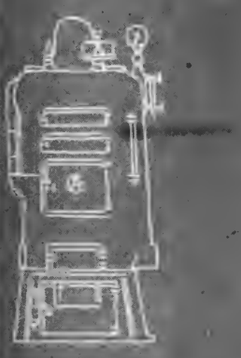
This bellows, drawn from a flat sheet of metal *without soldered seam* is at once the most flexible and powerful expansion member known to engineers. There is only *one* Sylphon bellows. It is made by The Fulton Company of Knoxville, Tennessee, and is used exclusively in Sylphon Damper Regulators.

Other famous Sylphon Damper Regulators are

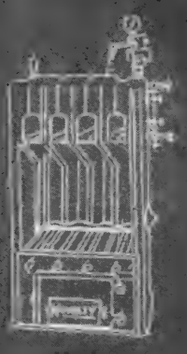
No. 45-A for hot-water boilers; No. 925 for vapor heating systems; No. 924 for low pressure (down to 6 ozs.) steam boilers.

All Sylphon Damper Regulators are made in standard iron pipe sizes and may be used on any make of boiler. Jobbers carry stocks.

Ask for Bulletin DR

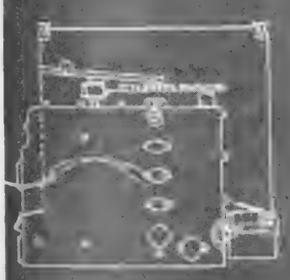


Abco

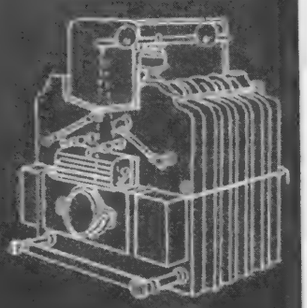


Novelty

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL SEAMLESS SYLPHON BELLOWS
Sylphon



Bernhard



Newport

THE FULTON COMPANY, KNOXVILLE, TENN.

New York Chicago Detroit Boston Philadelphia *Representatives in all principal cities in U. S.*

European representatives: Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. 1., England

Canadian representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

either from the ordinary gas tank heater, water back in coal range, indirect heater or coil in boiler, etc. as the hot water is conducted direct from the heating source to the faucet. It is calculated that its use reduces by one-half the cost of installing a gas tank heater. The company, as well as Mr. Dahlquist himself, is receiving congratulations on its continued success, as well as upon the development of this new product.

Elliott Co., Pittsburgh, Pa., announces the appointment of A. L. Rider, as district manager, with offices at 830 Massachusetts Trust Building, Boston, Mass. Until recently, Mr. Rider was associated with the Henry L. Doherty Company in connection with the operation of the Doherty properties in Toledo, O. In the Boston office Mr. Rider wil assume responsibility for Elliott Company activities in the New England territory, including the sale of Kerr turbines and the products of the Lagonda Mfg. Co., Springfield, O. and of the Liberty Mfg. Co., Pittsburgh, Pa.

Richmond Radiator Co., New York, has declared a dividend of 8¾% on its common stock, of which 1¾% applies to the last quarter of 1924 and 7% to the full year 1925. Of the dividend 3½% is payable January 15 and 1¾% regular thereafter at intervals of three months.

Central Station Heating Notes

Aberdeen, Wash.—Local capitalists have organized a company which will undertake to raise $150,000 for the purpose of building a central heating plant to heat the business buildings of Aberdeen.

Washington, D. C.—Plans have been completed for what is termed the largest steam heating plant in the world to heat 11 public buildings with a floor space of 3,400,000 sq. ft. It will be an oil burning system.

St. Louis, Mo.—Two appropriation bills for $1,000,000 to erect a municipal heating, power and lighting plant from bond issue funds has been approved by the Public Utilities Committee and sent to the Board of Estimate and Apportionment.

Portland, Ore.—Additional steam heating and electric power facilities has been placed in operation by the Northwestern Electric Company, at its Lincoln Street station. The main units of the new equipment are two new 1,000 H. P. steam boilers, said to be the largest in the State.

Detroit, Mich.—A proposed new $350,000 oil-burning municipal central heating plant to heat the seven municipal buildings in the group which includes Police Headquarters and Receiving Hospital, is being discussed by the council as a result of a petition for such a plant by Joseph S. Stringham, city research engineer. The plant would be underground in Clinton Park and would have an ornamental stack 125 ft. tall to carry fumes and smoke above the sky line. No condensation costs would be necessary, since the city owns the park, Mr. Stringham said.

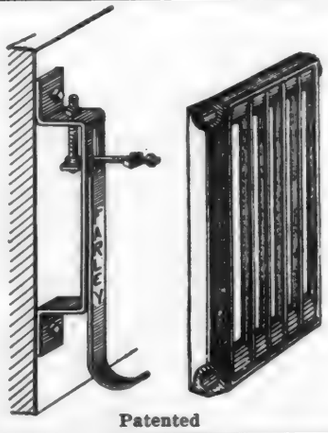
Colorado Springs, Colo.—Wood and Weber, Denver electrical engineers, have been engaged by the city of Colorado Springs to supervise the steam plant and other work under the city's municipal power development project under a contract providing a fee of 6 per cent. of the new construction costs. The city council has agreed on details of the contract to be entered into with Wood and Weber and instructed George M. Irwin, city attorney, to make a formal draft of the contract which is to be signed by the two parties.

Shelby, O.—The new steam line under process of construction from the municipal electric light plant to the new high school building is practically completed. The cost of the line will be $14,780. The estimate on the job was $16,500. When the new high school building is completed the building will be heated with exhaust steam from the light plant.

SEE OUR DETAILED DATA IN ASH&VE GUIDE

SEE OUR DETAILED DATA IN ASH&VE GUIDE

Boston Buffalo Chicago New York Philadelphia Los Angeles

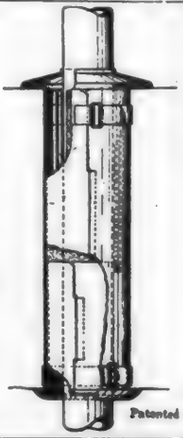


Patented

FARLEY
Hangers *and* Sleeves

This is the hanger you are looking for, made of hot rolled steel, will not break and made to fit any style of your radiation.

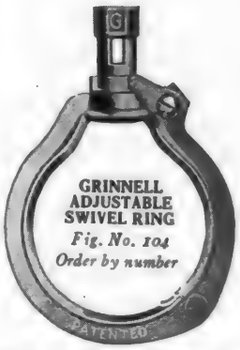
Fire resisting "Grab-on" sleeves are used in all classes of buildings. They are made to fit the condition of construction of the building. The only sleeve that will hold covering against the ceiling.


Patented

Send for descriptive literature

FARLEY SLEEVE AND HANGER COMPANY
3748 East 71st Street and Fleet Ave. Cleveland, Ohio

Adjustable before and after installation



The Split Ring Type of the Adjustable Swivel Ring was designed for use with Coach Screw Rod or with Machine Threaded Rod in the same way as the Solid Ring type. The Swivel Shank feature allows adjustment of about two inches.

Grinnell Adjustable Swivel Rings can be used with Coach Screw Rod or Machine Threaded Rod in connection with practically any type of Ceiling Flange, Expansion Case, Insert, etc.

TODAY any steamfitter, plumber or contractor can use the same method of cutting time costs as Grinnell Company.

Our Engineering and Installation Departments, in their constant effort to decrease installation costs, saw that big savings would result from using materials that could be adapted to varying conditions. The Grinnell Adjustable Pipe Hangers were consequently designed—hangers so easy to adjust that they do away with all the old-time tinkering and fussing.

Grinnell Adjustable Malleable Iron Hangers are now being supplied to all who want to speed up installation work and get a better-looking, more satisfactory and more finished job. The patented swivel shank, cast in one piece, permits adjustment both before and *after* the pipe has been put in place. The range of models is so complete that there's no need for "Specials" on complicated installations.

Write for Grinnell Hanger Catalog No. 2. Its illustrations and text describe the best made and easiest-to-use hangers on the market today. Send for a copy. Address Grinnell Company, Inc., 280 W. Exchange Street, Providence, R. I.

GRINNELL COMPANY

305 W. Exchange Street, Providence, R. I.

Fittings, Hangers, Valves, Pipe Bending, Welding, Piping Supplies, Etc.

New Incorporations

SANBORN-LINDEBLAD Co., Chicago, Ill., capital $25,000, jobbers. Incorporators: E. W. Sanborn, A. S. Lindeblad and Nellie C. Sanborn. The company is planning an expansion of its business which will include an increase in its sale force.

Bids Received

Evansville, Ind.—Bids were received as follows for a central heating plant for Boehne Hospital: General building contract, Scarborough-Davis, $9,278; heating system, Gottman-Weber, $24,500; plumbing, Newman-Johnson, $1,550. The new plant will supply heat to every building on the grounds with the exception of the nurses' home.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

ESTIMATOR WANTED — Heating and Ventilating Estimator must have A1 references. In applying state salary wanted to Estimator, 222 Market Street, Newark, N. J.

DESIGNING HEATING AND VENTILATING ENGINEERS WANTED—By Philadelphia contractor engaged on large work. Good opportunity for experienced man. Address with experience and qualifications. Box 24, care Heating and Ventilating Magazine.

DRAFTSMAN WANTED.—Heating and ventilating draftsman with at least two years' college training. In reply state education, experience, age, when available, salary required and send sample of drawing. Smith, Hinchman & Grylls, architects and engineers, 800 Marquette Building, Detroit, Mich.

ASSISTANT ESTIMATOR AND SUPERINTENDENT WANTED.—In Milwaukee, Wis., a man thoroughly experienced in heating and ventilating work as an assistant estimator and superintendent. In making application state age, experience and salary expected. Address Box 21, care Heating and Ventilating Magazine.

SALESMEN WANTED.—Experienced salesmen to call on heating trade are needed by a nationally-known manufacturer of steam and water boilers and radiators. State age, experience, present employment and give references. Address Box 22, care Heating and Ventilating Magazine.

SALES AND HEATING ENGINEERS WANTED.—Several openings in New York and Philadelphia territory with a progressive steam and hot water boiler manufacturer. Men who have earned $6000 a year or better are wanted who can fit into a growing organization. Apply with full particulars of past selling record and connections and state when available to Box 23, care Heating and Ventilating Magazine.

POSITION WANTED.—Mechanical drafting and design work, layouts, inspection and reports, machinery drawing and design. John A. Thwaites, Room 819, 949 Broadway, New York.

SALES ENGINEER WANTED.—Sales engineer acquainted with heating and ventilating trade to represent, in special territory, superior hot-blast heaters. Liberal arrangement to a capable, live wire. Address, with experience and qualifications, Heating, 710 Union Trust Building, Chicago, Ill.

SALESMEN WANTED.—Salesmen wanted for several good territories to handle well-established heating system. Commission basis. Side line no objection. Address Box 14, care of Heating and Ventilating Magazine.

CANADIAN DISTRIBUTORS with warehouse facilities and Dominion wide connection in heating field seek additional lines. Address Box 124, care of Heating and Ventilating Magazine.

PATENT AND PROTECT
Your valuable inventions
and
Register your trade marks.
Prompt attention. Superior Service
Lester L. Sargent, Patent and Trade Mark Atty.
524 10th Street, Washington, D. C.

"Weight" Does Not Interfere With Correct Location of the WING FEATHERWEIGHT

Eight small bolts support this High Ceiling Type Wing Featherweight Unit Heater. Easily installed without alterations or extensive piping.

The great bulk and tremendous weight of old style heaters permit of only one location—on the floor. Their weight allows no choice (except at considerable expense for special supports).

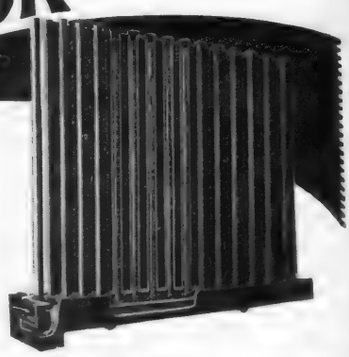
The success of the Wing Featherweight Unit Heater is due primarily to its proper location—overhead, made possible by its small dimensions and extremely light weight.

From the position illustrated above, the Wing Featherweight Unit Heater heats the working level first, maintains an even temperature, and prevents the accumulation of warm air at the ceiling—all because of the fact that from the point at which it is installed it sets up a vertical circulation from ceiling to floor.

L. J. Wing Mfg. Co.

Fans and Blowers *Damper Regulators*
Unit Heaters *Small Turbines*
Hudson & 13th Sts. New York City

CHINOOK



RADIATION IS CHEAPER INSTALLED

Because its simplified construction eliminates troublesome assembly. There are no right-and-left hand threads and no return bends, els or other fittings are required; it is a complete, compact unit.

You are assured of a profitable finished job and a highly satisfied client.

Write for Bulletin No. 24, Bayley Chinook Heaters, a valuable reference book on heating, ventilating and drying.

BAYLEY MANUFACTURING CO.
742 Greenbush Street, MILWAUKEE, WIS.

Bayley
HEATING AND VENTILATING EQUIPMENT

THE SATURDAY EVENING POST
THE SATURDAY EVENING POST
These well known jobbers render an indispensable service to the American Public
MUELLER
THE SATURDAY EVENING POST
Why we plumbers recommend Mueller products
FAUCETS
faucets without a fault

A $14,000.00 Compliment to the Plumbers of America

If for nothing else, "shoot a nickel" for a copy of The Saturday Evening Post of January 31, just to see the above $14,000.00 compliment to the plumbers of America.

This is the first of a big series of advertisements that will appear throughout 1925. Through this work the Mueller Co. hopes to build up a stronger public good will for the entire plumbing industry. You can easily capitalize this great campaign. Let your jobber tell you how.

MUELLER CO., Decatur, Illinois

Established 1857

Factories—Decatur, Ill., Fort Huron, Mich., Sarnia, Ont.
Branches—New York — Los Angeles — San Francisco

MUELLER

faucets without a fault

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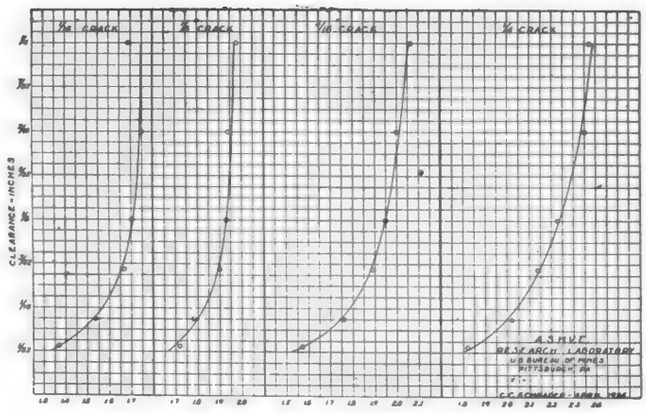


Fig. 1. Air leakage—cubic feet per hour per foot of crack per mile of wind velocity. Window equipped with Interlocking Type of Weather Strip.

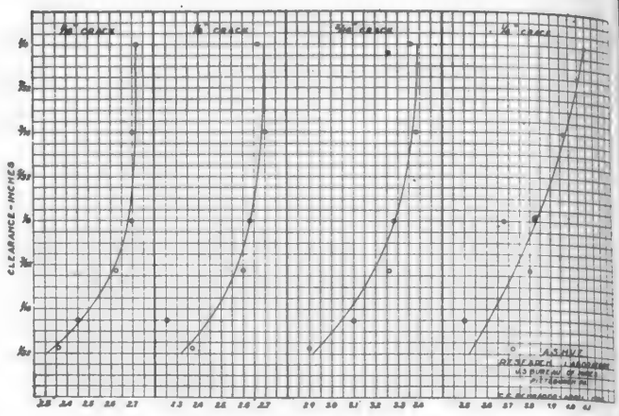
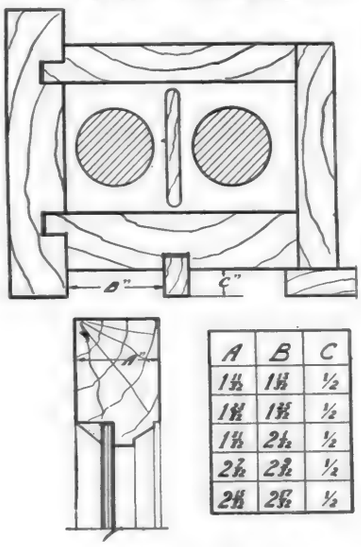
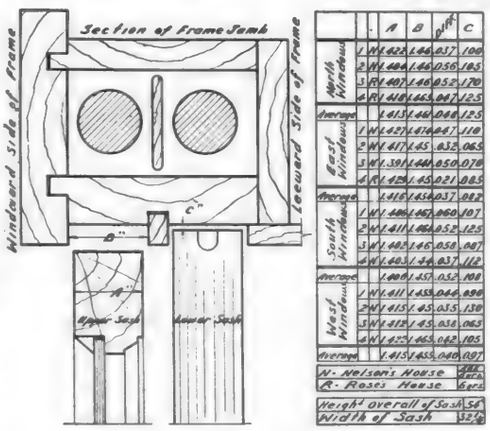


Fig. 2. Air leakage—cubic feet per hour per foot of crack per mile of wind velocity. Window equipped with Rib Type of Weather Strip.



A	B	C
1 1/2	1 13/16	1/2
1 13/16	1 15/16	1/2
1 15/16	2 1/16	1/2
2 1/16	2 3/16	1/2
2 3/16	2 5/16	1/2

Fig. 3. Dimension diagram of double-hung sash. Original signed by Huttig Sash and Door Company, St. Louis.



		A	B	diff	C
North Windows	1 W	1.422	1.46	.037	100
	2 W	1.404	1.46	.056	185
	3 W	1.407	1.46	.052	170
	4 W	1.418	1.465	.047	125
Average		1.413	1.46	.048	125
East Windows	1 W	1.427	1.474	.047	110
	2 W	1.417	1.45	.033	065
	3 W	1.391	1.441	.050	078
	4 W	1.429	1.45	.021	085
Average		1.416	1.454	.037	082
South Windows	1 W	1.486	1.467	.060	107
	2 W	1.411	1.464	.052	125
	3 W	1.402	1.465	.058	087
	4 W	1.603	1.44	.037	112
Average		1.488	1.457	.052	108
West Windows	1 W	1.411	1.455	.044	090
	2 W	1.415	1.45	.035	130
	3 W	1.412	1.45	.038	065
	4 W	1.422	1.465	.042	105
Average		1.415	1.455	.040	097
N - Nelson's House					100 Cent.
R - Rose's House					82 Cent.
Height overall of Sash					54
Width of Sash					32.4

Fig. 4. Shrinkage diagram of double-hung sash, from investigation and report of University of Wisconsin School of Engineering (Steam and Gas Dept.). Made by D. W. Nelson and R. A. Rose. Approved by B. Spieth, Assistant Professor.

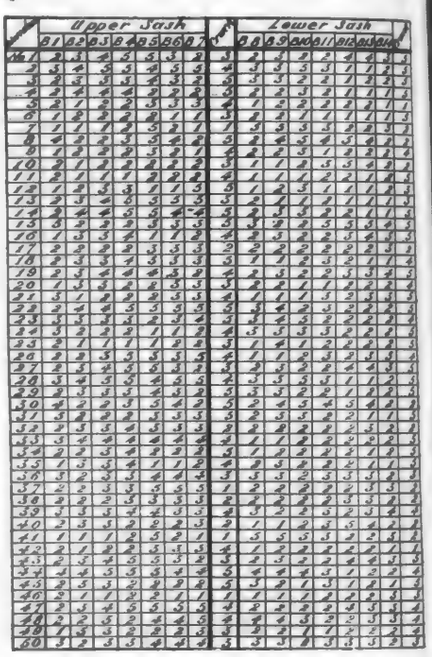


Fig. 5. Crack and clearance diagram. Use plate numbers only for cracks and clearances.

No. 1 plate = 1/32 inch; No. 2 plate = 1/16 inch; No. 3 plate = 3/32 inch; No. 4 plate = 1/8 inch; No. 5 plate = 5/32 inch.

COMPARATIVE LEAKAGES

Double Hung (Sliding) Window 1 3/8" Sash

Leakage C.F.H. per ft. Crack per mile wind Velocity

B.T.U. per hour per ft. crack per mile wind Velocity 70° Temp. Diff

Non-Stripped window				Monarch #400 Interlocking Weather Strip						Tongue & Groove (Rib Type) Weather Strip							
Crack "A"		1/16" to 1/4"		1/16"		1/8"		3/16"		1/4"		1/16"		1/8"		3/16"		1/4"	
		INF.	BTU	INF.	BTU	INF.	BTU	INF.	BTU	INF.	BTU	INF.	BTU	INF.	BTU	INF.	BTU	INF.	BTU
Clearance	1/16	2.1	2.65	.3	.38	.4	.50	.6	.76	.7	.88	1.2	1.51	1.4	1.76	1.7	2.14	2.3	2.90
	3/32	2.9	3.65	.4	.50	.5	.63	.7	.88	.9	1.13	1.3	1.64	1.5	1.89	1.9	2.39	2.4	3.02
	1/8	3.7	4.66	.4	.50	.6	.76	.8	1.01	.9	1.13	1.4	1.76	1.6	2.01	2.0	2.52	2.5	3.15
	5/32	5.0	6.30	.4	.50	.6	.76	.8	1.01	1.0	1.26	1.4	1.76	1.6	2.01	2.0	2.52	2.7	3.40

Note: Plain or Non-stripped window figures are for both sashes locked at meeting rail

If frames are not calked add 1.9 Cu. ft. of air per lineal foot of crack per mile wind Velocity

Frame crack = Height plus width x 2

Add 21 Cu. ft. per opening per mile wind Velocity for elsewhere leakage

Sash perimeter = 3 x width plus 2 x Height

Fig. 6. Table of comparative infiltration thru non-stripped, rib-stripped and Monarch-stripped double-hung (sliding) window. Computed by C. C. Schrader and taken from data given in his June report at the Kansas City Convention of A. S. H. & V. E.

on Air Infiltration

your own files

An excerpt from the report of Messrs. Houghton and Schrader of the H. & V. E. Laboratories, published on page 469 of the June, 1924, issue of the Journal of the American Society of Heating and Ventilating Engineers, reads as follows:

"A comparison of the two figures (1 and 2) brings out the greater consistency in results obtained with the interlocking type of strip, which is to be expected, as this type of weatherstrip holds the sash in the same position at all times. With the rib strip, the sashes are free to move from side to side a distance depending on the size of the crack and, since it is impossible to return them to exactly the same position after each test, the results become more varied. This change of position of the sash often causes the leakage with a small clearance to be greater than with a large clearance, for a slight change is sufficient to affect the difference. This is particularly true when the crack is large and permits considerable divergence from the previous position of the sash."

To determine the variation existing between the thickness of the sash and the width of the runway between stops and parting bead of windows, a detailed cross-section drawing thru the side rail and box of a double-hung window was made and sent by the Monarch Metal Products Company to 20 leading planing mills in different sections of the country with the request that each fill in the dimensions. The replies indicate that the minimum clearance is $^1/_{16}$ inch. (See figure 3.) This clearly proves that a minimum clearance of $^1/_{16}$ inch exists *before any shrinkage takes place.*

To learn the average degree of shrinkage, similar detailed drawings were then forwarded to 20 universities where actual measurements of windows were taken. At each university, sixteen windows were measured—four on the north, four on the south, four on the east and four on the west side. These windows had been in place from 5 to 30 years each. The minimum crack reported was $^3/_{64}$ inch, the maximum $^{17}/_{64}$ inch, the average $^3/_{16}$ inch. The minimum clearance reported was $^3/_{64}$ inch, the maximum $^9/_{64}$ inch, the average $^3/_{32}$ inch. (See figure 4.)

Next, 12,500 windows in 50 different localities of the United States were measured. Cracks and clearances were determined by inserting steel plates varying in thickness from $^1/_{32}$ inch to $^1/_4$ inch between the sash and stop. The result is shown in figure 5. The figures in this report each represent $^1/_{32}$ inch.

This data—the report of 20 leading planing mills on standard mill practice regarding window dimensions; the report of 20 universities on the average degree of shrinkage over a period of years; and actual measurements taken from 12,500 windows in 50 different localities—all indicate the reasons for C. C. Schrader's conclusion—

"The greater consistency in results obtained with the interlocking type of strip is to be expected."

A comparison of the differences in infiltration thru windows without weather strips, with tongue-and-groove (rib) type strips and Monarch Interlocking Equipment No. 400 is given in figure 6. This table was computed by C. C. Schrader and taken from data given in his June report at the Kansas City Convention of A. S. H. & V. E.

In the light of facts proved by more than 600 tests conducted by F. C. Houghton and C. C. Schrader for the A. S. H. & V. E. under the direct supervision of the A. I. A.; and additional data on cracks and clearances taken from actual measurements, the Monarch Metal Products Company will very shortly discontinue the manufacture and sale of rib type strips thru its direct representatives.

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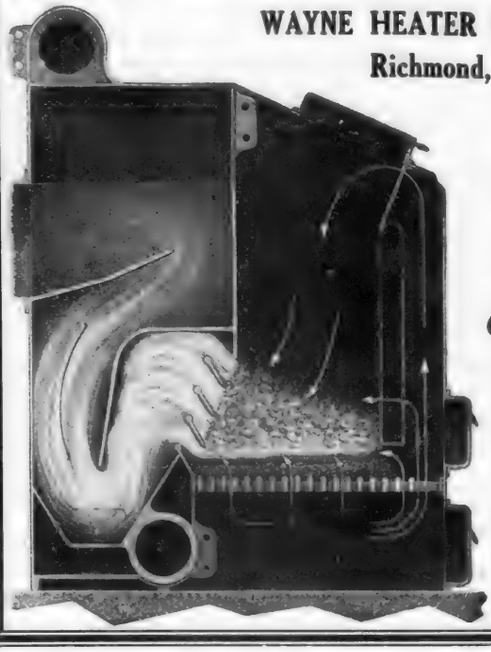

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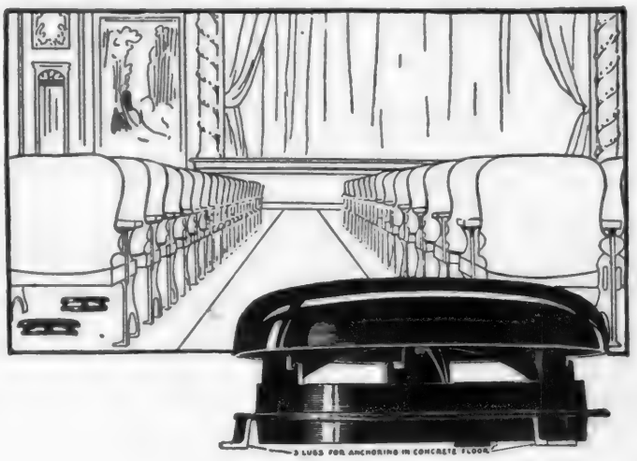

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See Descriptive Booklet

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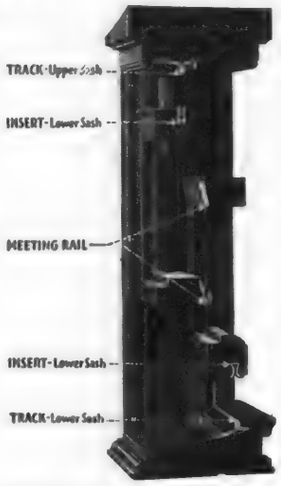

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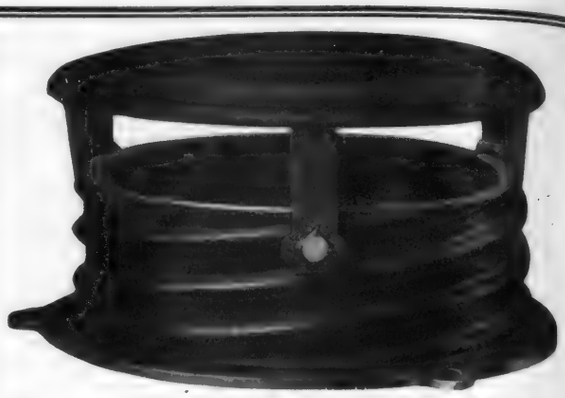

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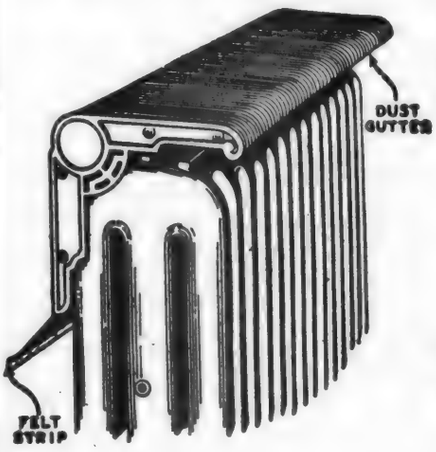

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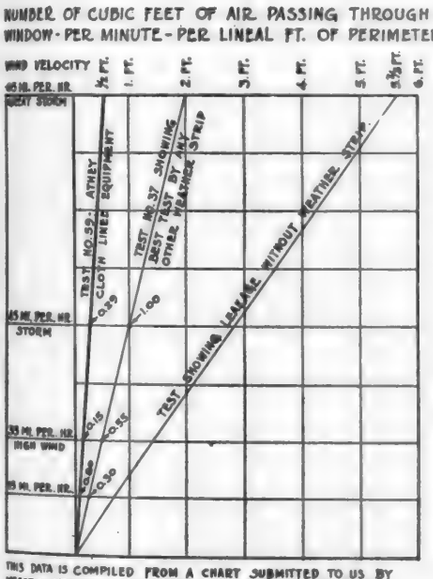

THIS DATA IS COMPILED FROM A CHART SUBMITTED TO US BY MESSRS. MCKENZIE, VOORHEES & GMELIN, ARCHITECTS, NEW YORK CITY, WHO MADE EXHAUSTIVE TESTS OF THE VARIOUS WEATHER STRIPS FOR THE AMERICAN TELEPHONE & TELEGRAPH CO, AND OF WHICH WE SHOW ONLY THE ATHEY TEST AND THE NEXT BEST, THE OTHERS DEVELOPING GREATER LEAKAGE.

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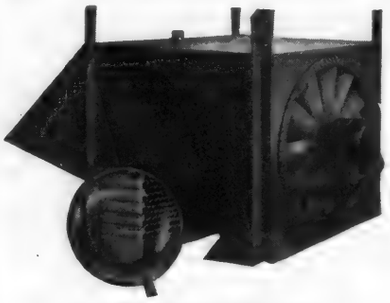

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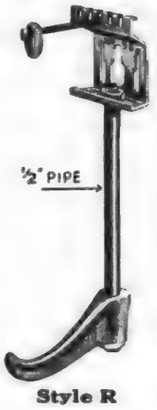

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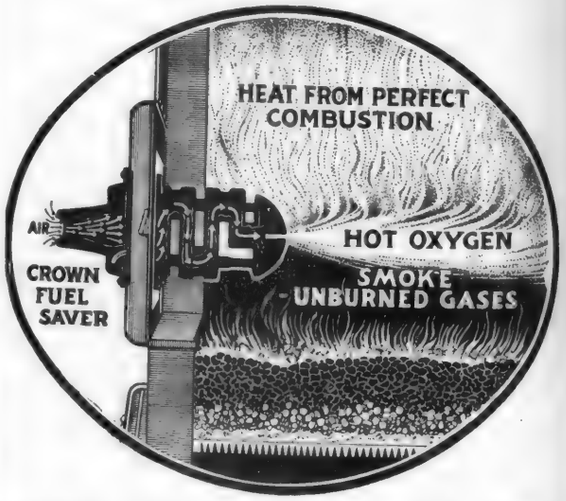

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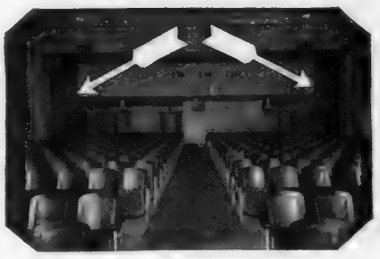

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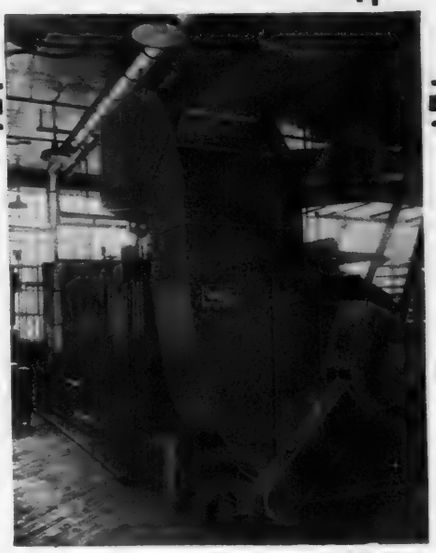

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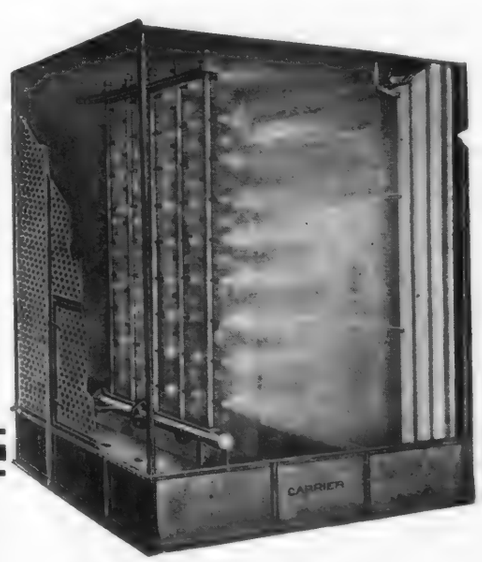

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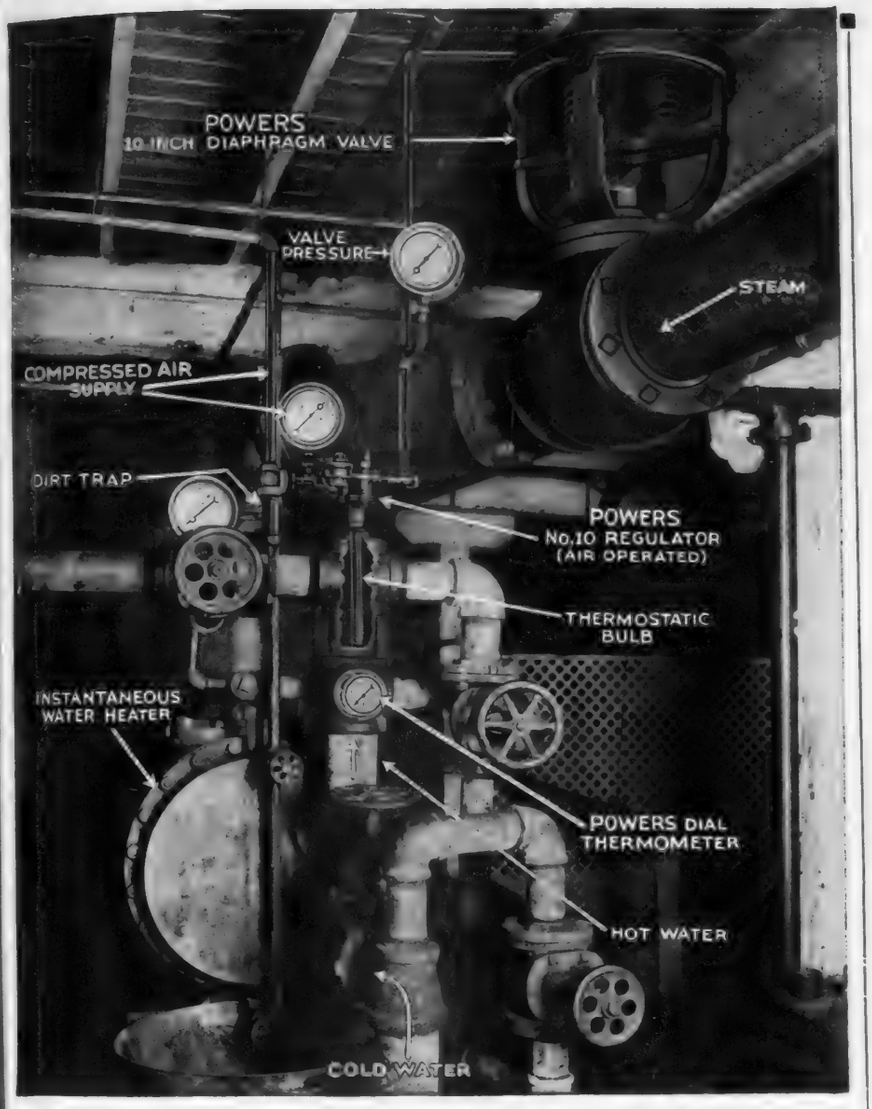

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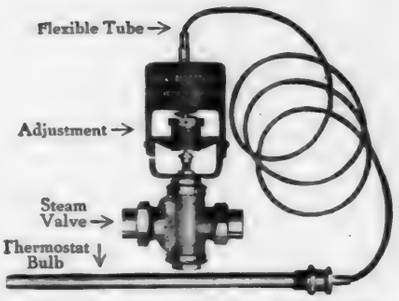
In studying the problems of your clients, you no doubt find many places where accurate temperature control would save hundreds, perhaps thousands, of dollars a year. Every dollar spent for *hand* control of temperature is money gone forever, same as rent. Experience shows that money invested in Powers control pays handsome dividends.

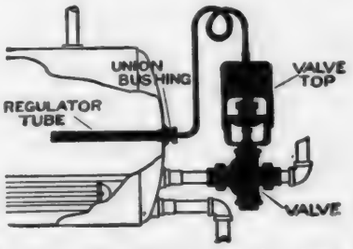
Here is an instance where Powers temperature control is turning *unseen losses* and *profit leaks* into INCREASED EARNINGS:

Large Chicago packers have a reputation for turning all but the squeal of a hog into money. These firms quickly saw the money to be saved with automatic temperature control. In their killing operations, immense amounts of hot water at accurate temperatures are required. Water too hot not only wastes fuel but often spoils the product and slows up production. For these reasons Powers control, as applied to the heater shown above, pays big dividends each year. One Chicago packer has installed three of these controls, one 10 inch, see photograph above, and two 8 inch, and is now ordering four more. (Name upon request.)



Regulator for Tanks, Vats, Kettles, etc.

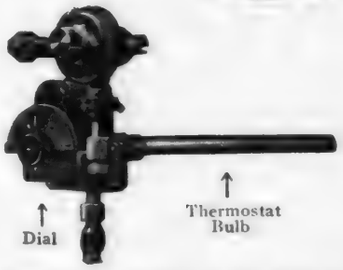
This device automatically controls the temperature of liquids. You simply set it for the temperature you want. It maintains that temperature, and does not vary more than 2° above or below the point for which it is set. You can adjust it for different temperatures if desired. It is easy to install and needs no compressed air or water for its operation. Send for bulletin 129.



This shows the application of the above regulator to a hot water storage tank. This regulator is adapted to all makes of heater and storage tank systems. Water heating, Water cooling, Steam Cookers, Pasteurizers, Acid baths, Feed water heaters, Glue heaters, etc., may all be made automatic with this regulator.

When used on the hot water service of Hotels, Apartments, Office, School and Shop Buildings, Hospitals, Laundries, Industrial Plants, etc., economy of fuel, labor, and fixtures is secured, which is not otherwise obtainable.

Diaphragm valve at right is shown in the large photograph. It controls the flow of steam to the water heater, and is operated by the regulator shown below.



The regulator shown above is also shown in the large photograph. The tube at the right is the thermostatic bulb, and extends downward, in the photograph, into the hot water line, where its sensitive content reacts to the temperature of the water, thereby controlling the diaphragm valve.

THE POWERS REGULATOR COMPANY

34 years of specialization in temperature control

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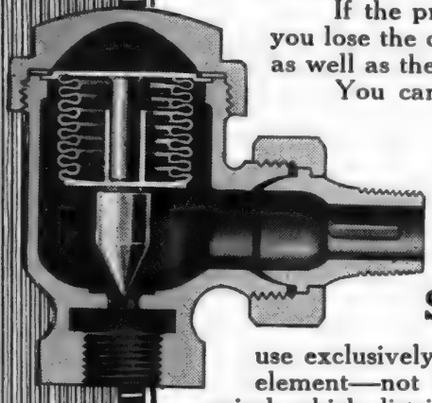
Traps and Valves Make Friends for You



If the products you specify do not give entire satisfaction, you lose the confidence of your customer and his future business as well as the business of his friends.

You can stake your reputation on Sarco Radiator Traps, Inlet Valves, Steam Traps, Temperature Regulators and Strainers. They are **guaranteed** to give absolute satisfaction and there is a long established concern that has never broken a promise nor shirked an honorable obligation back of that guarantee.

SARCO RADIATOR TRAP

use exclusively the Sarco helical tubing for the expansion motor element—not annular corrugations, but a continuous helix, or spiral, which distributes the movement evenly in such a way that the metal never tires. This means a high lift and a clear open discharge and extends indefinitely the life of the trap.

Sarco Radiator Traps are substantially made and handsomely finished.

They are now installed in many of the largest and finest buildings from coast to coast.

They are the highest grade Radiator Trap sold at competitive prices.

Send for Booklet P-114.

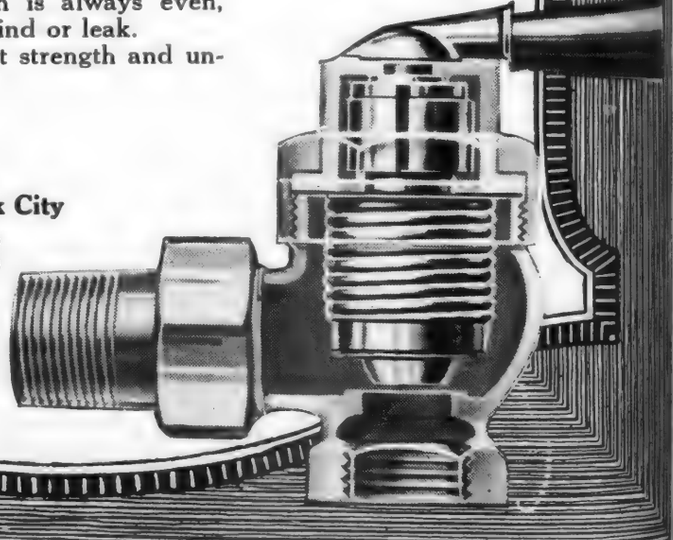
SARCO PACKLESS INLET VALVE

uses the unique Sarco helical tubing and is of the true packless type.

Can be opened or closed by a ¾ turn of the handle, the pressure of which is always even, smooth and regular. Won't bind or leak.

A high-class valve of great strength and unusually handsome design.

Send for Booklet P-152.



SARCO CO., INC.

231 Broadway, New York City

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Peacock Bros., Limited
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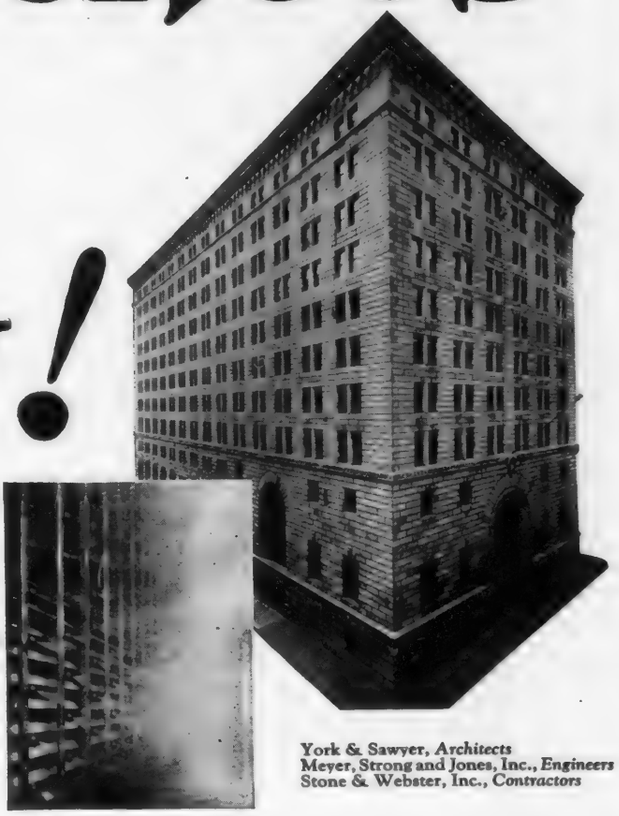
5 Buckets of Dirt a Day!

and the Reason



York & Sawyer, *Architects*
Meyer, Strong and Jones, Inc., *Engineers*
Stone & Webster, Inc., *Contractors*

IN the First National Bank Building of Boston twelve million cubic feet of air per hour is supplied by Sturtevant Silentvane Fans and Air Washers.

By means of the latter, the air in this building is washed to make it pure. And every night attendants carry away five buckets of dirt, mud and other impurities, taken out of the air, that otherwise would have been discharged into the bank's offices and committee rooms.

Air is drawn in from the outside—thoroughly laundered by Sturtevant Air Washers and circulated thru-out the rooms and corridors of this building.

Engineers who select Sturtevant Air Washers obtain the highest type of air washing apparatus.

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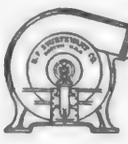

Sturtevant
PUTS AIR TO WORK

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and their
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are all listed in our installation booklet just off the press—men who approve "UNIVERSAL."

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"The Universal Unit Ventilation System"

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Sign on the dotted lines and we will mail the booklet at once.

Name .....

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CLEAN AIR is a Part of Most Ventilating Problems

The great majority of engineers and architects know that the air of practically all of our cities today is so full of dust and bacteria that some means of cleaning it must be provided in the solution of ventilating problems of every kind.

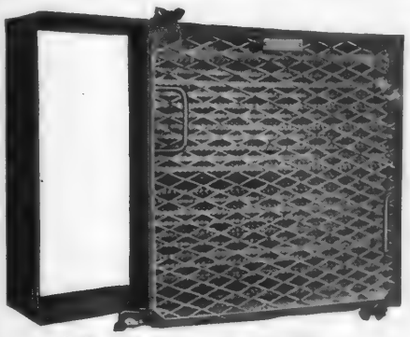
The Midwest Air Filter installations made in 1924 are convincing evidence of the growing practise of providing for clean air in buildings where a proposal to install air filters would have met with ridicule a few years ago.

Here is a partial list of the various kinds of buildings in which Midwest Air Filters have been installed during 1924 as a result of their specification by the leading engineers and architects of the country:

Art Galleries	Hotels
Auditoriums	Libraries
Banks	Museums
Baths	Office Buildings
Chain Stores	Private Homes
Churches	Restaurants
Clubs	Schools
Department Stores	Telephone Exchanges
Factory Offices	Temples
Hospitals	Theatres

These are the kind of buildings for which you are called upon to provide adequate ventilation. That includes clean air. We are at your command to show you why Midwest Air Filters should be chosen for this service, and to co-operate with you to the fullest extent.

Write Dept. F-4 for a quotation on any of the current jobs on your boards involving the types of buildings listed above.



Cell and frame of the New Model Type U-2 Midwest Air Filter.

MIDWEST AIR FILTERS

Are based on the baffle-impingement principle which insures the removal of all harmful dust and bacteria, and prevents the building up of excessive resistance due to clogging. The new model Type U-2 is an improvement over all previous models and makes, from the standpoint of efficiency, capacity, ease of handling, and operating costs. A careful study of the sturdy construction, basic principle and fundamental characteristics of the new model Type U-2 will convince any unbiased engineer of its superiority over all other air cleaning equipment now on the market.

MIDWEST AIR FILTERS

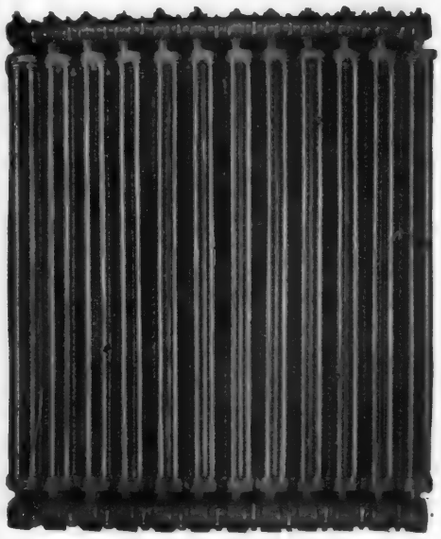
INCORPORATED
100 EAST 45TH STREET
NEW YORK CITY

Midwest Canada Ltd.
83 Craig St. West
Montreal, Canada

Offices in Principle Cities

Midwest Air Filters Pacific, Inc.
Monadnock Building
San Francisco, California

Why the Lyon Interlocking Heaters are Best for Hot Blast Heating



Front view of Heater made up of 5 rows of 12 sections each, 70" on 5" centers, and containing 1050 sq. ft. of heating surface with 13.2 sq. ft. Free Area. Weight 5820 lbs.

BECAUSE Guaranteed against cracked or broken sections under steam pressure up to 100 lbs.

—Light in weight, avoiding expensive foundations or supports where used on upper floors or roofs.

—Made to fit in space of any height from 40 inches to 140 inches in steps of 10 inches, thus avoiding piling up or decking.

—Made in small units that can be assembled in the building, and handled through any window, door or small opening.

—Heating surface closely assembled, thus giving greater heating surface in smaller space.

—All prime heating surface with the resulting high efficiency.

—Are pipe heaters, admitting steam at the top, the force of which drives the air down to the air vents at the bottom, thus assuring rapid and uniform circulation.

—Have all advantages of old style pipe heaters (in satisfactory use for forty years), with objectionable features of bulk and weight removed.

—Made of full strength Spellerized pipe, virtually rust and corrosion proof.

—Headers and bases are pressed in by hydraulic pressure without threading—sections assembled with extra heavy right and left nipples.

—Designed for extreme conditions, such as 40° below zero intake temperature and velocity up to 2000 feet per minute, under which conditions of temperature, humidity and velocity, the condensation becomes excessive.

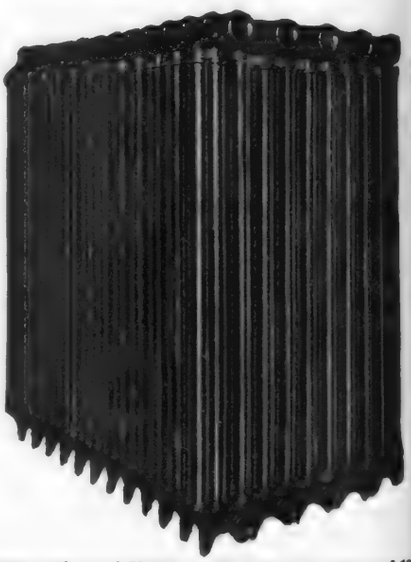
—Price compares favorably with that of other heaters, and their light weight saves on freight. Cost of installation also much less.

Specially Adapted Where Ventilation Required

A Lyon Interlocking Heater was installed several years ago in the laundry building of the Y. M. C. A., Chicago, and proved so satisfactory that we have just sold our Lyon Interlocking Heaters for use in the Y. M. C. A. Building of Austin, Ill. and the Y. M. C. A. Building of Englewood, Ill.—these two buildings in the suburbs of Chicago—estimated to cost $600,000 each.

These heaters have been adopted and are being used by a number of the largest MANUFACTURERS of UNIT HEATERS through out the country.

We recently made shipment for one of the large fan manufacturers of Chicago, to one of the large railroad companies where PRESSURE OF 140 LBS. WAS REQUIRED. These heaters were tested in the presence of the fan company's engineer to 180 lbs. hydraulic pressure without leaks or sweats of any kind, to the great delight and satisfaction of the witnessing engineer.



Corner view of Heater made up of 5 rows of 12 sections each, 70" on 5" centers, and containing 1050 sq. ft. of heating surface with 13.2 sq. ft. Free Area. Weight 5820 lb.

Valuable Data FREE

Our 68 page catalog containing over 70,000 result figures of *data on final temperatures and condensations from certain intake temperatures and velocity*, which cost over $2,000 in cash and over 350,000 figures to compute, mailed free to Engineers, Architects and Contractors of record—write for it.

LYON PRODUCTS COMPANY, Inc.

314-316 Union Park Court **CHICAGO, ILL.**

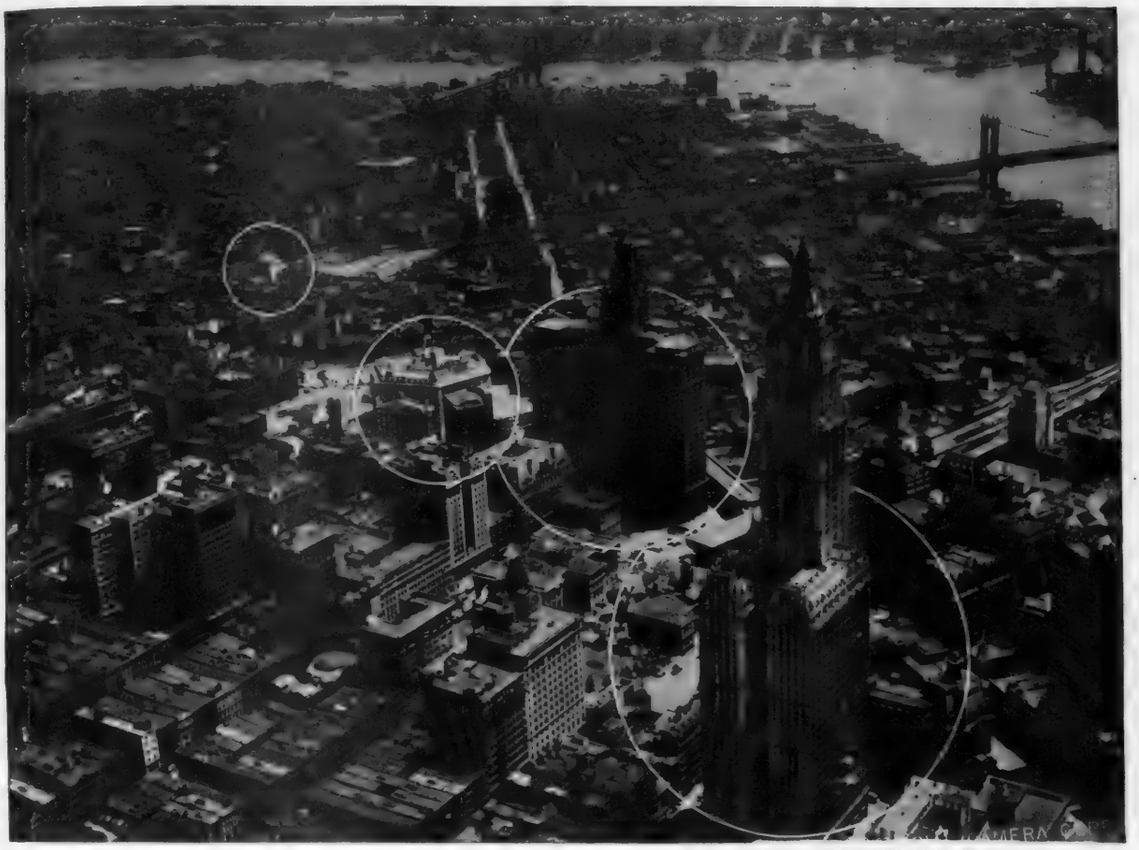


Photo by Fairchild Airial Camera Corp., N. Y

Four of the Finest Buildings in Downtown New York

have installed in them the Massachusetts Blower Company's fans. These buildings—designated by the white circles—are the Woolworth Building, Municipal Building, New York County Court House, and The Citizens National Bank Building.

The Massachusetts Squirrel Cage Fans are backed by twenty-five years' experience.

From New York to San Francisco we could draw white circles on the skyline where prominent buildings have them installed, and where they have proven economical, efficient and dependable under all sorts of operating conditions. *Let us mail you our complete technical data.*

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Constant Supply of Hot Water at Right Temperature at All Times

If you can assure, at all times, a plentiful supply of Hot Water heated always at the right temperature, isn't a small additional expenditure for your Hot Water System justified?

Installing the Honeco Temperature Controller means comparatively little extra expense, but it does mean considerably more satisfactory service and you save coal in addition.

Honeco
HOT WATER SUPPLY
Temperature Controller

is adapted for all types of Hot Water Heaters. Easily installed —requires no care or attention —guaranteed to give perfect satisfaction.

Prices and Honeco Bulletin R-14 on request.

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THE SCHAEFFER & BUDENBERG MFG. CO
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Temperature - Pressure - Humidity, etc.

Foxboro Gauge Board at the Knickerbocker Portland Cement Co., Inc., Hudson, N. Y.

What is the Life of FOXBORO Instruments?

The use of one hundred thousand Foxboro instruments in a majority of the giant central stations and great industrial plants of the country is an overwhelming acknowledgment of their superior accuracy and dependability.

"But is this greater accuracy and dependability of Foxboro instruments gained at the expense of sturdiness?" we were asked recently.

To answer this question we dug into the past —looked up sales orders as far back as 1910 and frankly asked our customers what service Foxboro instruments have given.

15 Years and Still Going Strong

Read a few of the replies we received. This is remarkable testimony of Foxboro longevity.

The Corno Mills Co.— Cedar Rapids, Ia.
is glad to say that the Foxboro Recording Gauge, purchased May 10, 1911, is still in use and giving accurate results. It has operated 24 hours a day and every day in the year since being installed.

Berry Brothers, Inc.— Detroit, Mich.
"The Foxboro Recording Thermometer purchased March 23, 1911, has been in service daily, registering up to 600 degrees, and is still in excellent condition. This instrument has never been repaired."

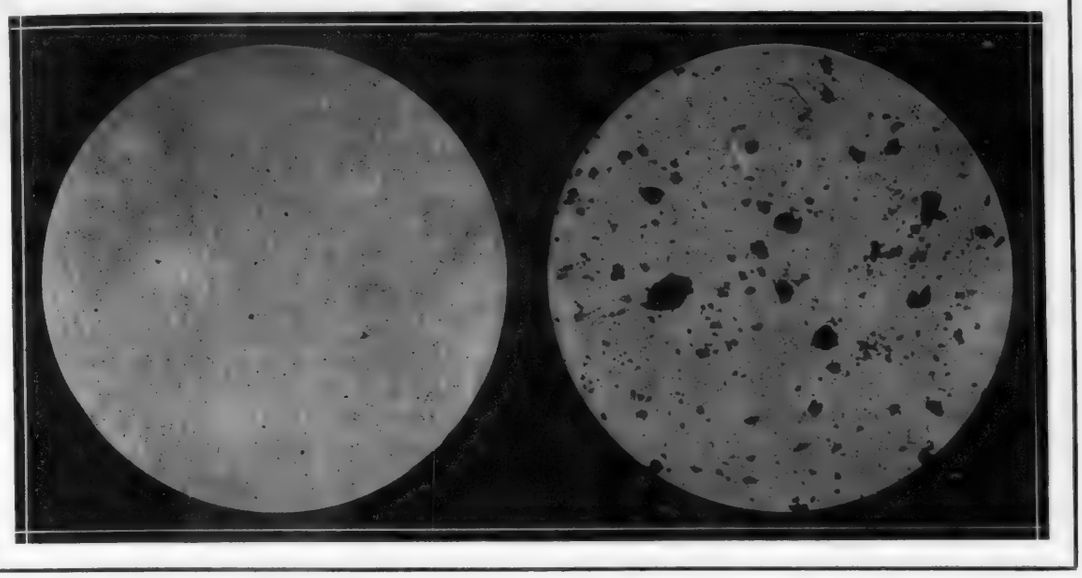
Just as the United States Government came as a matter of course to Foxboro for air speed indicators to equip the famous Round-the-World Cruisers, so do engineers and manufacturers in all lines of industry come to Foxboro when they are in need of accurate, dependable indicating, recording and controlling instruments, sturdy enough to withstand long years of service.

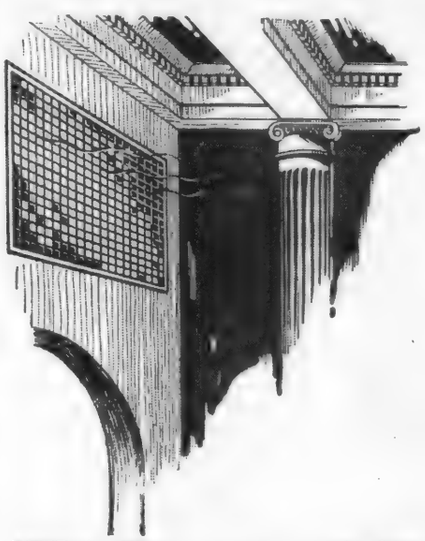
Write for Bulletin R96-1.

THE FOXBORO CO., INC.
Neponset Avenue, Foxboro, Mass., U.S.A.
New York Chicago Boston Philadelphia Pittsburgh Cleveland Rochester Birmingham Tulsa Los Angeles San Francisco Portland, Ore.

FOXBORO
TRADE MARK
THE COMPASS OF INDUSTRY
Indicating - Recording - Controlling

REED AIR IS CLEAN AIR





REED Air Filters are used to supply clean air for the ventilation of:
Hotels, Restaurants, Schools, Stores, Banks, Churches, Theatres, Offices, Factories, Etc.

VISUAL EVIDENCE
that REED AIR is Clean Air

THESE two micro photographs tell the story graphically. The one on the right shows the normal dust content in average city air, magnified 60 diameters. Over 80% of this dust is carbon—soot, coal dust, etc.—the remaining 20% comprises road dust, sand, fine particles of metal and other grit.

At the left is shown the small amount of dust in the air after passing through a REED filter. *Reed Air* is clean air—guaranteed 97% free from dust and carbon. Used wherever clean air is required. Facts and figures upon request.

REED AIR FILTER COMPANY, Inc.
215 Central Ave., Louisville, Ky. 50 Church St., New York City
Offices in Principal Cities

REED AIR FILTER COMPANY, Inc.
Engineering Department
215 Central Avenue, Louisville, Ky.

Gentlemen: Please send me without obligation your informative folder, "Are You Interested in Clean Air?"

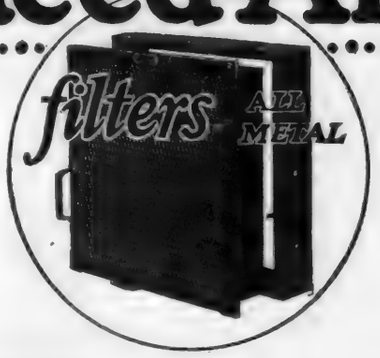
Application.....C.F.M.

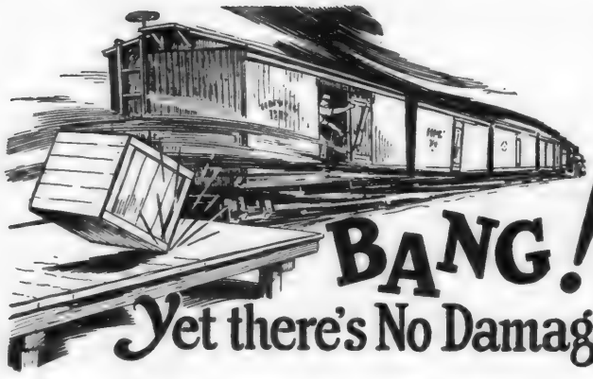
.....

Name.....

Address.....

Reed Air
TRADE MARK





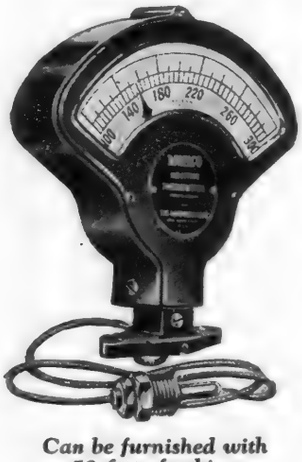
BANG! Yet there's No Damage

ROUGH handling in transit or in your plant holds no terror for this rugged thermometer. It has no fragile glass tube—no levers, hair-springs, gears or other delicate parts to break or get out of adjustment.

Shows screw for recalibrating

Even if rough handling throws the Motoco Thermometer slightly out of calibration, it can be quickly re-calibrated *right on the job.* Think of the time, trouble and expense that saves! This is a feature found only in the

MOTOCO
INDUSTRIAL THERMOMETER



Can be furnished with 50 feet of tubing

By simply turning the screw shown in above illustration the pointer may be moved to the desired position.

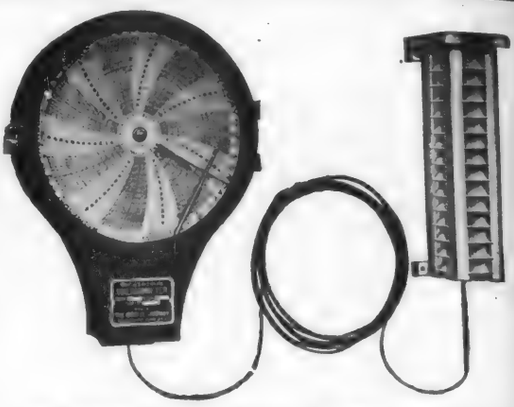
Motoco Thermometer is built for *long life*—the thing you *pay* for. And the thing you *get* in the Motoco even though you pay no more for this *easy-to-read dial* thermometer than you'd have to pay for a high-grade armored glass-tube thermometer.

Made for temperatures from minus 40° to plus 750° F. with tubing or straight or angle stem.

Don't buy another thermometer until you read our interesting catalog No. 7.

Write for a copy

The MOTO METER CO., Inc.
Industrial Thermometer Division
7 Wilbur Avenue
LONG ISLAND CITY, N. Y.
Made by the manufacturers of the famous Boyce Moto Meter



BETTER RESULTS FROM HEATING AND VENTILATING SYSTEMS—

are induced by

TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE

Recording Instruments

The illustration above shows Recording Thermometer suitable for taking outdoor atmospheric temperatures. It is provided with a long flexible connecting tube so that the instrument can be installed indoors and the sensitive bulb in a weather-house outside.

This is particularly suitable for apartment houses, hotels, public buildings including schools, theaters, municiple, etc.

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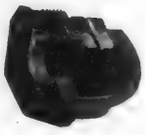

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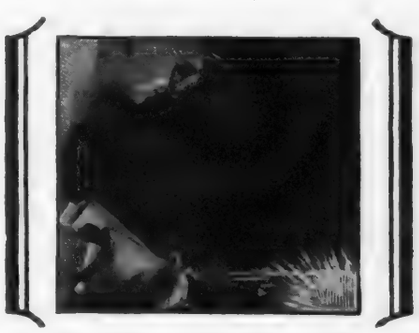

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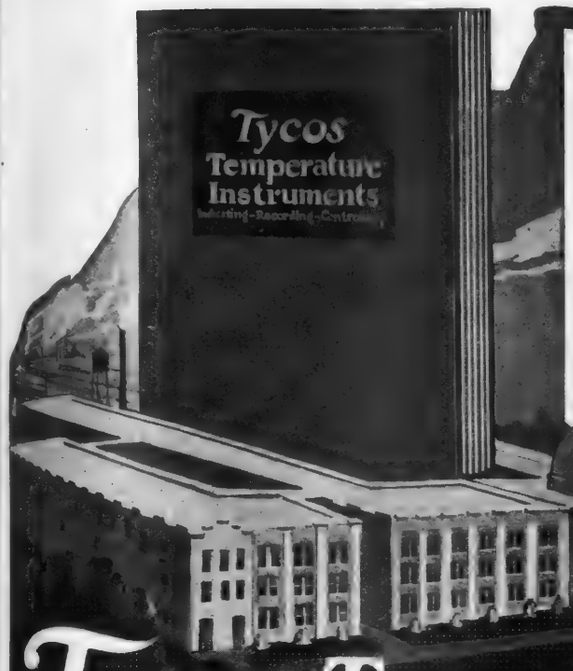

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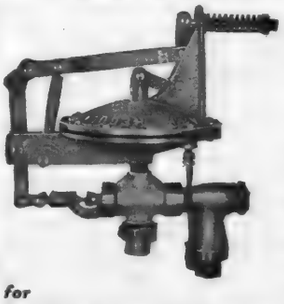

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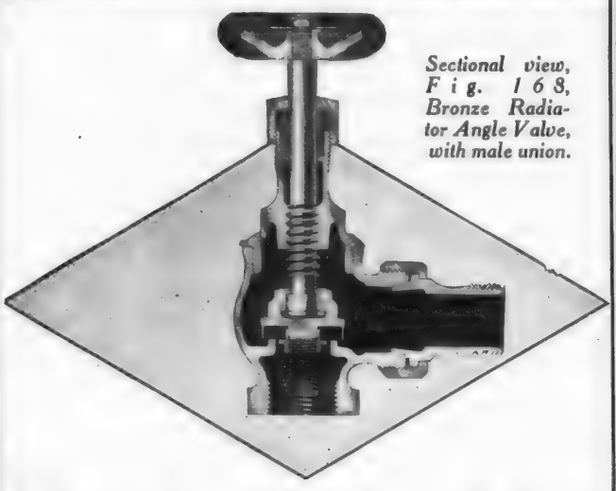

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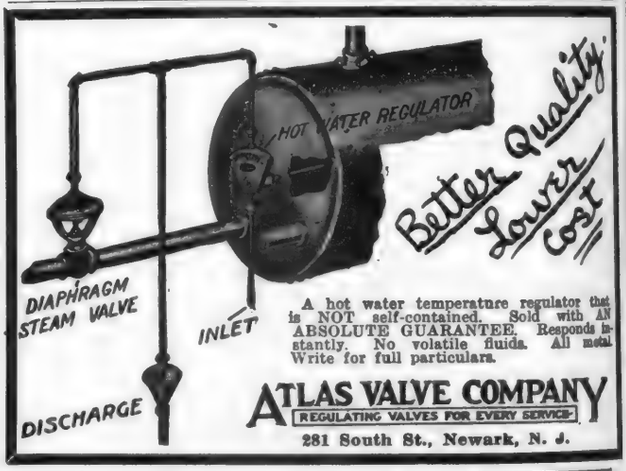

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Standard Bronze Gate Valves

Fig. 27

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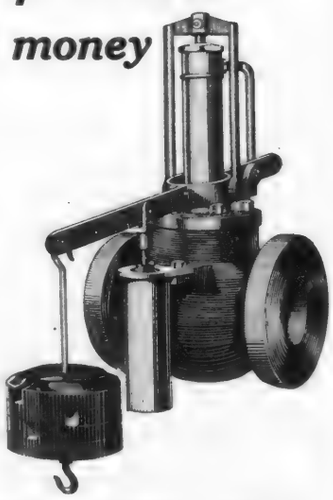

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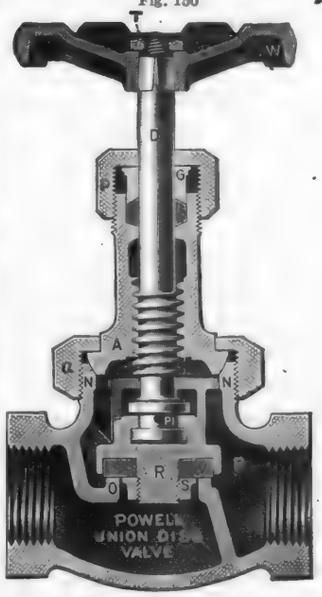
Fig. 150



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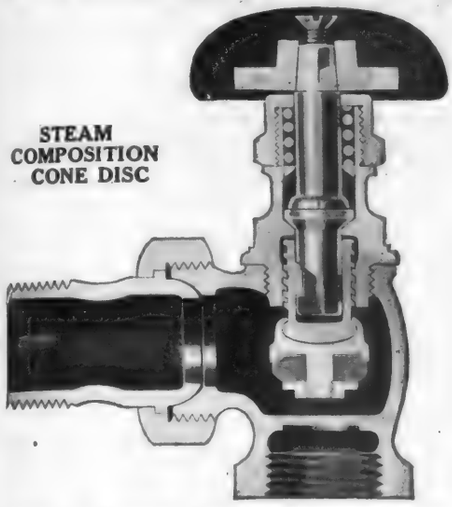

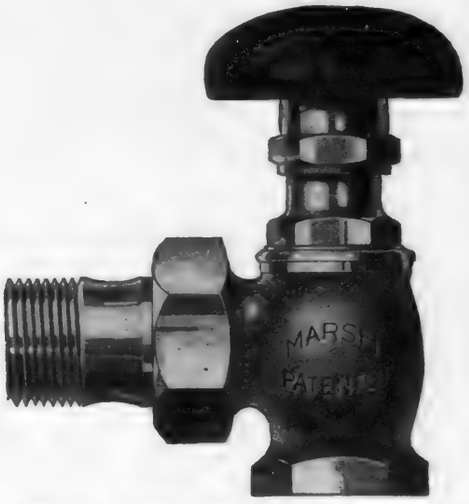

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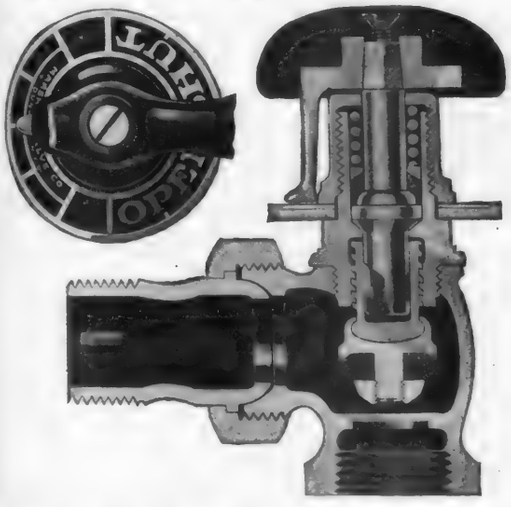

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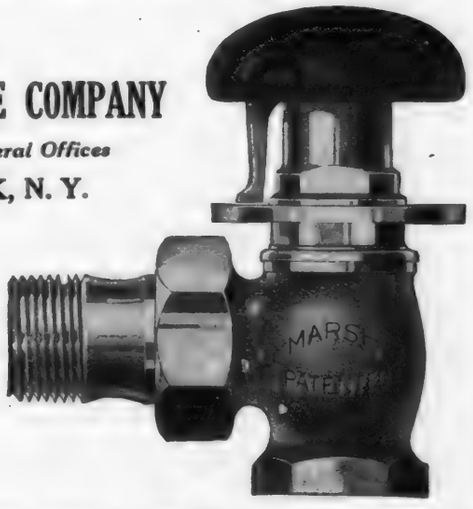

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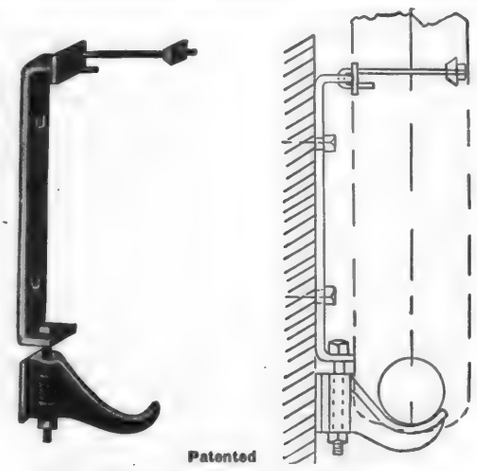

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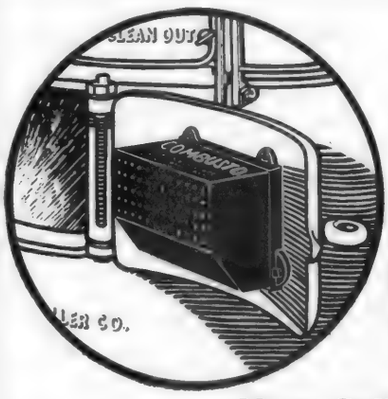

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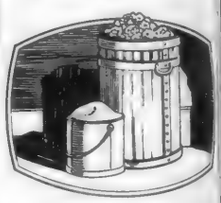

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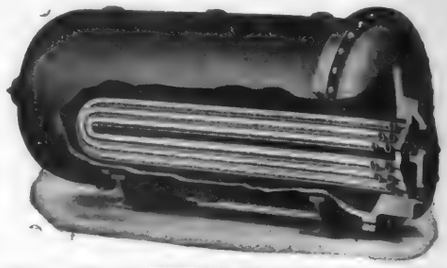
"He's certainly been giving us great hot water service lately. He tells me he's been handed lots of bouquets (cigars, more likely) since the owner installed that National Storage Heater and yet it costs less to run and doesn't make half as much trouble for him."

Bulletin 65 explains why the National Storage Heater saves fuel and cuts down repair and maintenance costs. Ask for a copy.



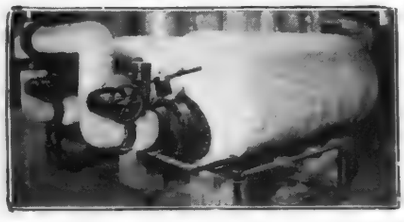
NATIONAL
U BEND TYPE
STORAGE HEATERS

The National Pipe Bending Company

120 RIVER STREET *Established 1883* NEW HAVEN, CONN.

Canadian Representative: Grant E. Cole Company, Toronto, Ont. 7660

ALBERGER BUFFALO HEATERS



Alberger Heaters are known the country over for efficient heat transmission, unusual accessibility and reliable service.

ALBERGER HEATER CO. 291 Chicago St.
HOWARD IRON WORKS Buffalo, N. Y.

CENTRAL STATION STEAM CO.

2912 East Woodbridge St.
DETROIT, MICHIGAN

MANUFACTURERS OF
Cadillac Condensation Meters
Detroit Feed Water Meters

Packingless Expansion Joints and other special fittings for underground steam distribution mains.

KIELEY
REGISTERED TRADE MARK

Steam, Water and Air Specialties

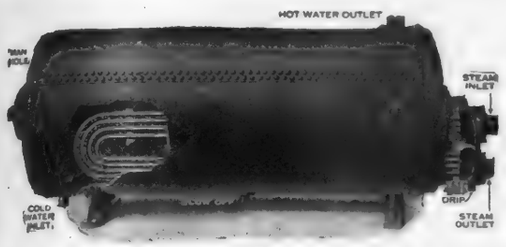
'98 REDUCING VALVE
125 Lbs. to 1 oz.

Manufacturers of the Complete Line

Send for Catalog 1923

KIELEY & MUELLER, Inc.
Main Office and Works
34-38 West Thirteenth Street
New York, N. Y.

RETURN TRAP
High or Low Pressure



Patterson Combined Hot Water Service and Storage Heater—Type B.

Ready for Sudden Heavy Demands

This heater is adaptable to:

Clubs
Hotels
Apartment Houses
Association Buildings
Institutions
Bleacheries
Dye Houses
Canning Plants
Laundries
Paper and Pulp Mills
Textile Plants
Industrial Plants, etc.

Where the demands for hot water are not constant or where a large volume of water must be held in storage for sudden, heavy demands, the Patterson Combined Hot Water Service and Storage Heater fills the requirements. It operates with either live or exhaust steam—high or low pressure—automatically controlled, or in connection with low pressure, vacuum or vapor heating systems.

Our Engineering Service is offered without obligation, and the requirements of each installation are considered carefully before making recommendation as to type or capacity of the heater to be used.

Where installations are made in accordance with our recommendations, we positively guarantee satisfactory hot water service.

Patterson-Kelley Co.,

Water Heating Engineers

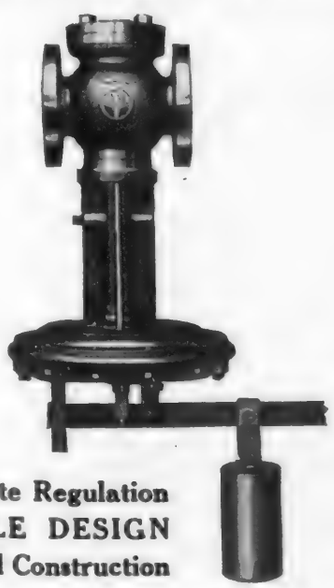
107 E. 40th St. New York

USE A MASON

Lever Style Reducing Valve

on your next

HEATING CONTRACT

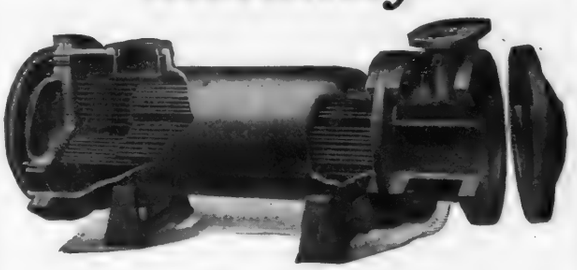


Accurate Regulation
SIMPLE DESIGN
Rugged Construction

MASON REGULATOR COMPANY

Boston, Mass. San Francisco, Cal. Montreal, Canada

Hot Water *instantly*



WITH THE

G-R Instantaneous Heater

any quantity—any temperature for hotels, apartments, laundries, etc.

Send for Bulletin 232

THE GRISCOM-RUSSELL COMPANY
2155 West Street Building
NEW YORK

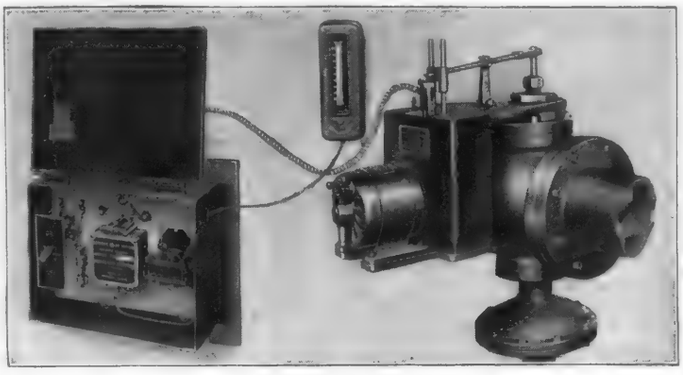
"Master Control" Saves Central Stations 35% to 60%

Read the following excerpts from an article by Mr. Woodworth in The Heating and Ventilating Magazine for September, 1924.

—H. A. Woodworth

(3014)

"To reach the most practical conclusions as to economy gained by automatic pressure temperature control, the writer made a series of tests, and the results showed savings of from 35% to 60%."



Hornung's "Master Control" Valve

"'Master Control' does not interfere with individual control of rooms or radiators. It means that radiation can and should be cut off 65% of the time when the outside temperature is 40°, the average temperature of our heating season. It means that the central station and the customer will benefit equally by controlling the heat down to actual requirements."

"The writer recommends that all heating companies stress the automatic temperature control, and thereby slow down the customers' meters at night and on mild days. The waste heat which they are selling to a dissatisfied customer at their lowest rate, could be sold to a new customer at a higher rate, thereby making two satisfied customers."

"'Master Control' is particularly well adapted to Central Station heating, as it requires no attention at any time, being electrically controlled. Many of the central heating companies throughout the country are using this type of control, and recommending it to their customers. The cost of maintenance is negligible."

Central Heat Appliances *J. C. HORNUNG Engineer* **343 S. Dearborn St., Chicago**

SIMS CLEAN E-Z

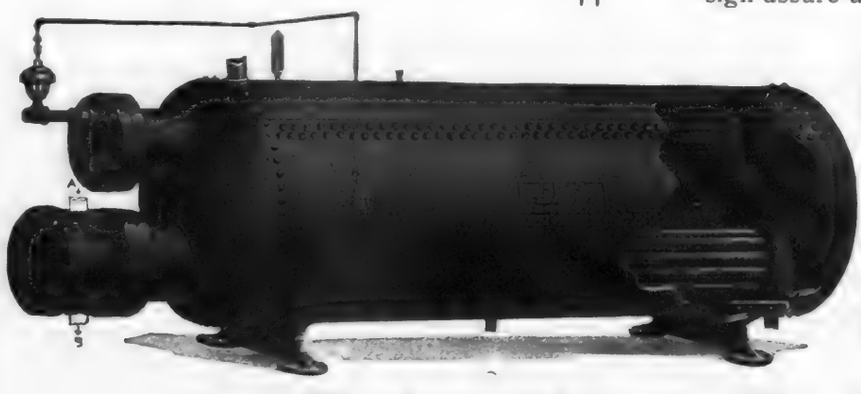
For hotels, apartment buildings, hospitals, Y. M. C. A. buildings, schools and laundries

Special Attention Given to Installations Requiring Large Quantities of Hot Water, with Live or Exhaust Steam as the Heating Medium.

Steam Tube Storage Heaters

In specifying heaters reliability is of first importance. Engineers who know "Sims" Heaters recommend them because they know "Sims" can be relied upon at all times. Their sturdy construction and correct design assure uninterrupted hot water service.

Our Engineers will gladly confer with you, without obligation, on your hot water problems.



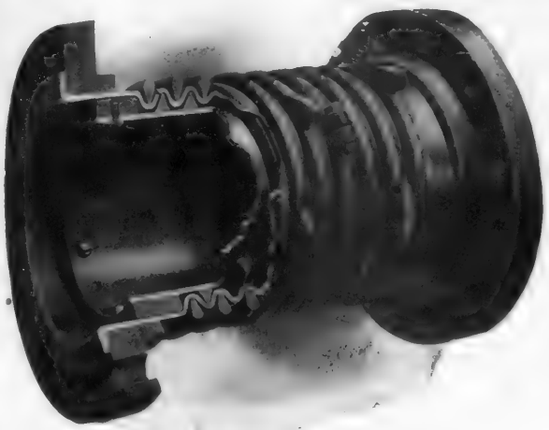
THE SIMS CO.

Erie, - - Pa.

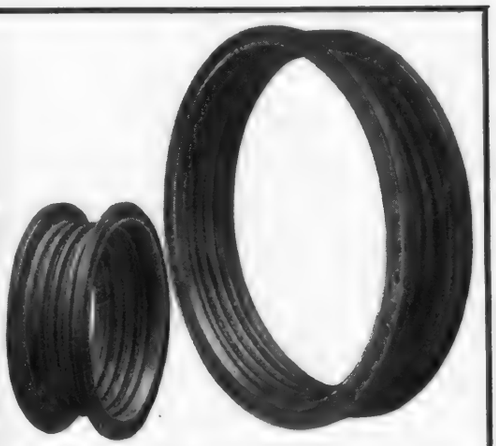
"We keep others in Hot Water"

The Wainwright
Improved Expansion Joint

Suitable for Pipe Movement of 1½ to 2 inches In Sizes 3" to 24"



Wainwright Improved Expansion Joint



This joint is designed for use between turbines and condensers for low pressure or vacuum work, is rated for 3/8" maximum movement and its four corrugations afford unusual flexibility for this light service. They have become the

"ACCEPTED STANDARD"

as offering the utmost that can be secured in a quality joint for this purpose.

THESE fittings are of the packless type —no stuffing box to be continually adjusted—no packing to blow out, deteriorate and require frequent replacement. The multiple corrugated copper expansion tube of uniform thickness and strength absorbs the movement.

Outside AND INSIDE expansion equalizing rings assure equal distribution of movement among the several corrugations.

The joint is protected from erosion and abrasive wear by the inner hard brass or copper sleeve which also affords smooth passage with least friction loss to steam, water, or gas being handled.

The Wainwright Improved Expansion Joint is offered suitable for pressures up to 150 lb. for hot or cold water, gas, oil, or steam, for total temperature, not exceeding 375 deg. F. For unusual service, the parts may be made of special materials or protected by tinning.

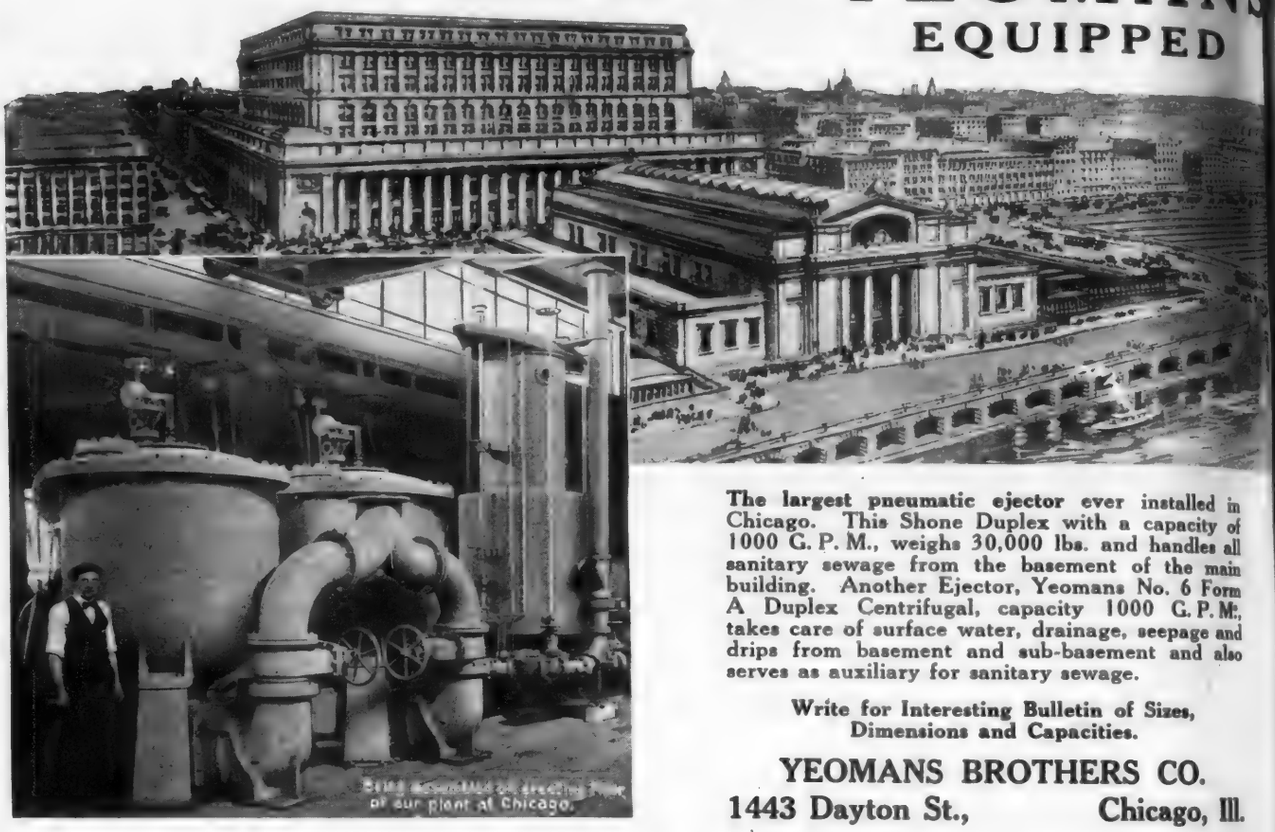
We will appreciate the opportunity of discussing special problems. Bulletin V-46, containing sizes, rating tables and layouts for typical installations, as well as information on Wainwright Anchors and Guides, will be sent on request.

WHEELER CONDENSER & ENGINEERING CO.

149 Broadway, New York

Works - CARTERET, N.J., NEWBURGH, N.Y.

CHICAGO'S NEW UNION STATION
YEOMANS
EQUIPPED



The largest pneumatic ejector ever installed in Chicago. This Shone Duplex with a capacity of 1000 G. P. M., weighs 30,000 lbs. and handles all sanitary sewage from the basement of the main building. Another Ejector, Yeomans No. 6 Form A Duplex Centrifugal, capacity 1000 G. P. M., takes care of surface water, drainage, seepage and drips from basement and sub-basement and also serves as auxiliary for sanitary sewage.

Write for Interesting Bulletin of Sizes, Dimensions and Capacities.

YEOMANS BROTHERS CO.
1443 Dayton St., Chicago, Ill.

SHUR-TITE

IT NEVER FAILS

Reg. U. S. Patent Office

Guarantees a Tight Job

Pour it in the boiler and start the fire.

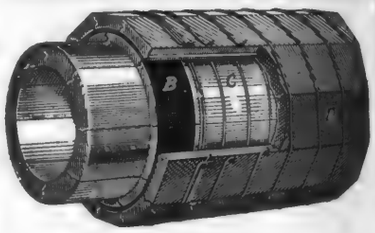
Stops all leaks while teste are being made.

Shur-Tite Boiler Cement is a Powder—100% efficient—No waste.

Use it on both new and repair jobs. Liberal trade discounts.

The Shur-Tite Mfg. Co.
1912 Cleneay Ave., Norwood, Ohio

Wyckoff's Improved Cypress Covering

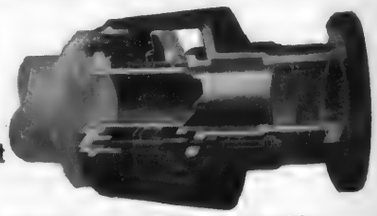


Lasts as Long as The Pipe Itself

As well as being highly efficient in its application, Wyckoff Improved Cypress Steam Pipe Covering withstands all conditions attending steam pipe trenches. All engineers who know Wyckoff Pipe covering specify it because it lasts.

A. WYCKOFF & SON CO. ELMIRA, N. Y.

ROSS
Crosshead-GUIDED Expansion Joint Excels in



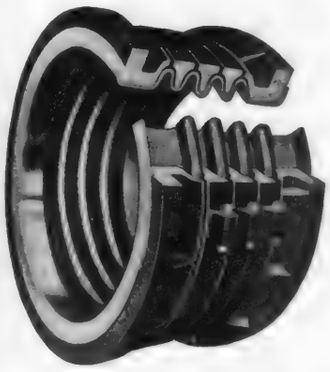
Design, Construction and Workmanship
Over 60% of sales—Repeat Orders
Once Used—Always Demanded
Every Purchaser—A Customer

ROSS HEATER & MFG. CO., INC., BUFFALO, N. Y.

New York, Chicago, Philadelphia, Boston, Cleveland, St. Louis, Detroit, Pittsburgh, Baltimore, San Francisco, Seattle, Denver, Salt Lake City, Omaha, Montreal, Toronto.

RETAIL BUSINESS DISTRICT OF BOSTON
SERVED BY CENTRAL STATION.

Central Station Steam Lines Guarded—and Safe



Corrugations in the one piece, seamless copper expansion element are formed—giving uniform thickness and avoiding weak spots. Exhaustive tests have shown corrugations to be of proper depth.

The engineers who selected BARGER SELF-EQUALIZING EXPANSION JOINTS to safely protect the central station steam lines serving the section shown above, knew that BADGER EXPANSION JOINTS

—are compact, and occupy no more space than the pipe itself;

—can be bolted in place as easily as a flanged fitting;

—have a one-piece, seamless, corrugated copper expansion element, protected by iron rings, which distribute strain equally over entire joint and insure uniform expansion;

—have no complicated parts, and require no packing;

—will not leak, and require no further attention after being installed.

BADGER EXPANSION JOINTS have been specified for some of the largest installations, where most exacting requirements had to be met. The long, continuous service which they have rendered has built up an enviable reputation for BADGER EXPANSION JOINTS, the natural sequence of good quality and the right kind of engineering service.

Let Our Engineering Department Help You

E.B. BADGER & SONS COMPANY
75 PITTS STREET, BOSTON, U.S.A.

OFFICES IN

SYRACUSE	DETROIT	DALLAS	KANSAS CITY	HOUSTON	ST. LOUIS
PHILADELPHIA	INDIANAPOLIS	DENVER	CINCINNATI	LITTLE ROCK	PORTLAND, ORE.
PITTSBURGH	CHARLOTTE	SALT LAKE CITY	CHICAGO	OMAHA	MONTREAL
CLEVELAND	ATLANTA	MINNEAPOLIS	NEW YORK	SAN FRANCISCO	HAVANA

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.

Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc., W. L. New York.
Grinnell Company, Providence, R. I.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Filters, Inc., New York.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLING AND DRYING SYSTEMS.

Aerofin Corp., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc., W. L. New York.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Fifters, Inc., New York.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.

Jas. P. Marsh & Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Midwest Air Filters, Inc., New York.

AIR FILTERS.

Midwest Air Filters, Inc., New York.
Reed Air Filter Co., Inc., Louisville, Ky.

AIR SEPARATORS.

Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Badger & Sons Co., E. B., Boston, Mass.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower Co., Inc., New York.
Fleisher Co., Inc., W. L. New York.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.

BLOWERS.

Fan.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Pressure.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.

Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Turbine.

Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

BOILER CEMENT.

Johns-Manville, Inc., New York.

BOILERS.

Down-Draft.

American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
General Boilers Co., Waukegan, Ill.
Hart and Crouse, Utica, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Stanwood Corporation, Cincinnati, Ohio.

Heating.

American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Continental Heater Corp., Dunkirk, N. Y.
Cox Stove Co., Abram, Philadelphia, Pa.
General Boilers Co., Waukegan, Ill.
Gorton & Lidgerwood Co., New York.
Grinnell Company, Providence, R. I.
Gurney Heater Mfg. Co., Boston, Mass.
Heggie Simplex Boiler Co., Joliet, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Newport Boiler Co., Chicago, Ill.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Ross Boiler Co., Chicago, Ill.
Thatcher Furnace Co., Newark, N. J.
Titusville Iron Works, Titusville, Pa.
Utica Heater Co., Utica, N. Y.
Wayne Heater Corp, Richmond, Ind.
Weil-McLain Co., Chicago, Ill.

Power.

Heggie Simplex Boiler Co., Joliet, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Ross Boiler Co., Chicago, Ill.
Titusville Iron Works Co., Titusville, Pa.

CALORIMETERS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Sarco Co., New York.

COILS, PIPE.

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Simmons Co., John, New York.

Air.

New York Blower Co., Chicago, Ill.

CONDENSERS.

Alberger Heater Co., Buffalo, N. Y.
American Radiator Co., Chicago, Ih.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

CONVERTERS, HOT WATER.

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.
Wyckoff & Son Co., A., Elmira, N. Y.

COOLERS.

Oil.

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLING TOWERS.

Badger & Sons Co., E. B., Boston, Mass.
Cooling Tower Co., Inc., New York.

COPPER BOILERS

Dahlquist Mfg. Co., Boston, Mass.

COPPER KETTLES

Dahlquist Mfg. Co., Boston, Mass.

COVERING, PIPE.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.

DEHUMIDIFYING APPARATUS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Engineering Corp., Newark, N. J.
Fleisher Co., Inc., W. L., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

DISTILLERS, (Water).

Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.

DRAFT APPLIANCES.

Combustion Specialties, New York.
Crown Fuel Saver Co., Richmond, Ind.
Simmons Co., John, New York.
Wolff Coal Saver Co., Chicago, Ill.

DRYING SYSTEMS.

(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, New York.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

DUST COLLECTORS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Co., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

DUST DETERMINATORS.

Atmospheric Conditioning Corp., Phila., Pa.
Hill, E. Vernon Co., Chicago, Ill.

ENGINES.

Steam, Automatic.

American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.

American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

EQUALIZING LOOPS.

Hoffman Specialty Co., New York.

EVAPORATORS.

Boiler Feed Make-Up.

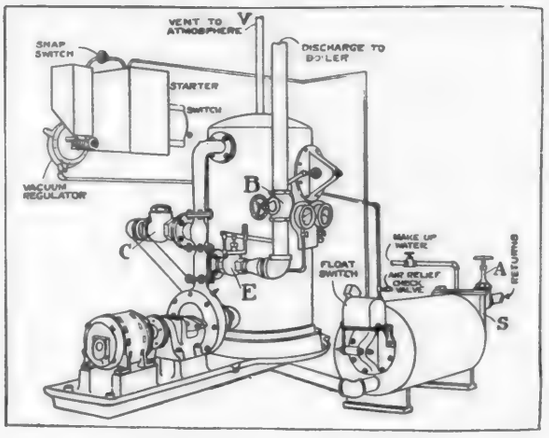
Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

EXHAUST SYSTEMS.

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wing Mfg. Co., L. J., New York.

EXHAUST HEADS.

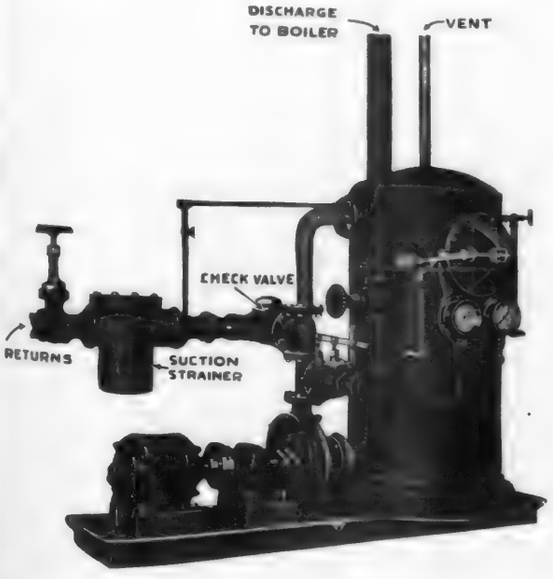
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons Co., John, New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wright-Austin Co., Detroit, Mich.



Automatic vacuum control with the dependable Young Centrifugal Pump

THE Young Centrifugal Vacuum Pump is well adapted to automatic control when equipped with accumulator tank fitted with float switch ahead of the pump, as shown in the line illustration above. Here the float switch can operate independently of the vacuum control, and as the accumulator tank is set down low, all return lines are kept dry.

The Young Pump thus equipped has a low operating cost factor on a fairly tight system. In some cases power bills have been cut fully one-third through the application of this pump. In a large school installation it was found that the automatic control cut in and ran the pump for but 15 minutes to build up an 8″ vacuum, which sufficed for two hours, with occasional operations of the motor to empty the accumulator tank and return water to the boiler. This occurred every 15 minutes for brief 40 second periods. The vacuum control was not called upon to function until the vacuum had dropped to 4″.



Best because simplest

The simplicity of the Young Pumps is almost proverbial. Indeed, so simple are they that an ordinary fireman can take care of their operation without difficulty. They also are economical in operation, give long service, and "stay on the job."

YOUNG PUMP COMPANY

230 East Ohio Street, Chicago

Factory: Michigan City, Indiana

ENGINEERS' SPECIFICATION INDEX (Continued)

EXPANSION JOINTS.

American District Steam Co., No. Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Dahlquist Mfg. Co., Boston, Mass.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Howard Iron Works, Buffalo, N. Y.
Illinois Engineering Co., Chicago, Ill.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.
Wheeler Condenser & Engineering Co., Carteret, N. J.

FANS, EXHAUST.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

FILTERS, (Aerating).

Griscom-Russell Co., New York.

Feed-Water.

Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED.

American District Steam Co., No. Tonawanda, N. Y.
Clow & Sons, Jas. B., Chicago, Ill.
Grinnell Company, Providence, R. I.
Simmons Co., John, New York.

FLANGES.

American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.

FLOOR SLEEVES.

Farley Sleeve & Hanger Co., Cleveland, Ohio.

GASKETS, METALLIC.

Sarco Co., New York.

GAUGE BOARDS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.

Altitude.

Pierce, Butler & Pierce Corp., New York.

Draft.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Hydraulic.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Ounce Graduated.

Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.

Pressure.

American Dist. Steam Co., North Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Bristol Co., Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Bishop & Babcock Co., Cleveland, Ohio.

Vacuum.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum (Compound).

Cashin Co., W. D., Boston, Mass.
Pierce, Butler & Pierce Corp., New York.

Water.

American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bristol Co., Waterbury, Conn.
Jenkins Bros., New York.

GENERATOR COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

GOVERNORS, (Pump).

Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

HEATERS.

Domestic Water.

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Dahlquist Mfg. Co., Boston, Mass.
Everhot Heater Co., Detroit, Mich.
Excelso Specialty Works, Buffalo, N. Y.
National Pipe Bending Co., New Haven, Conn.
Page Boiler Co., Wm. H., New York.
Patterson-Kelley Co., New York.
Pierce, Butler & Pierce Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Thermal Appliance Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Closed).

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims Co., Erie, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Open).

Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.

Alberger Heater Co., Buffalo, N. Y.
American Blower Co., Detroit, Michigan.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

Air, Fan System

Aerofin Corporation, Newark, N. J.
American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Portable Unit Air.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Pecco Incorporated, St. Louis, Mo.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass
L. J. Wing Mfg. Co., New York.
(See also Ventilators, Portable Unit.)

HEATING SYSTEMS.

"Gasteam"

James B. Clow & Sons, Chicago, Ill.

Vacuum.

Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Vapor.

American District Steam Co., No. Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Grinnell Company, Providence, R. I.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane & Co., La Crosse, Wis.
Vapor Heating Co., York, Pa.
Webster & Co., Warren, Camden, N. J.

Water.

Grinnell Company, Providence, R. I.
Thrush & Co., H. A., Peru, Ind.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Grinnell Company, Providence, R. I.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

HUMIDITY CONTROL.

American Blower Co., Detroit, Mich.
Atlas Valve Co., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Foxboro Co., Inc., The Foxboro, Mass.
Grinnell Company, Providence, R. I.
Klipfel Mfg. Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

INSTRUMENTS.

Electric Measuring.

Bristol Co., Waterbury, Conn.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bailey Meter Co., Cleveland, O.
Foxboro Co., Inc., The Foxboro, Mass.
Hill, E. Vernon Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Union Fibre Co., Winona, Minn.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Co., New York.

METERS.

Condensation.

American Dist. Steam Co., No. Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.

Feed Water.

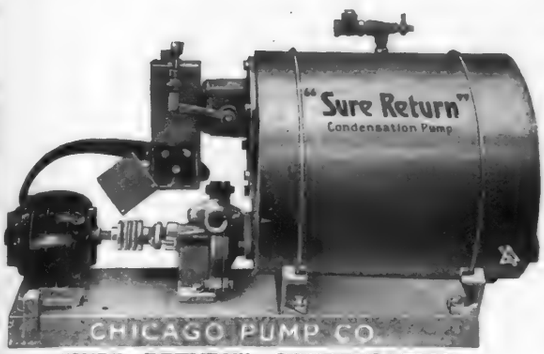
Central Station Steam Co., Detroit, Mich.
Simmons Co., John, 110 Center St., New York

Feed Water (Wier Type).

Webster & Co. Warren, Camden, N. J.

"CHICAGO" PUMPS

Give You
HIGH QUALITY at a REASONABLE COST

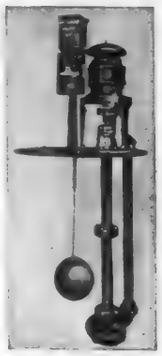


"SURE RETURN" CONDENSATION PUMP
Ask for Bulletin 47.

The best workmanship and finest materials obtainable are used in building "Sure Return" Condensation and "L-1" Bilge Pumps — yet we are able to sell them at very low prices.

Hundreds of each size are put through our modern shop at one time—but each unit gets individual care and inspection. Thus you are assured of a reasonably-priced, proper working outfit.

Try a "Chicago" pump on your next hard job. You will like the result.



"L-1" BILGE PUMP
Ask for Bulletin 48

CHICAGO PUMP CO.

2332 Wolfram Street Chicago, Ill.

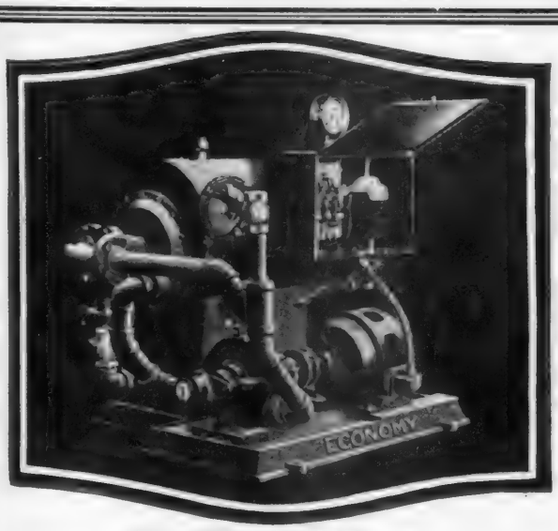


Fig. 2234. Single Pump

A Factory Kept Busy Without Display Advertising . . .

Economy Vacuum Pumps

The statement above tells that each Economy Vacuum Pump has been a silent salesman for another and another, until factory facilities had to be increased. We now must tell you we want more orders to keep the new machinery humming.

Economy Centrifugal Vacuum Pumps are now often recommended by Architects and Engineers who formerly confined their specifications to one certain type and make.

Economy Pumps are conservatively rated, scientifically designed, well built of highest quality material. Standard Units discharge against 20 pounds boiler pressure: they are well powered so motors do not burn out; they use no more electric current than any other pump that will do the same work. We do not advertise skimpy motor sizes but do advertise the fact that we do not burn up motors because they are too small.

Each Pump Fully Guaranteed

ECONOMY PUMPING MACHINERY CO., 71 to 122 No. Curtis Street, Chicago

ENGINEERS' SPECIFICATION INDEX (Continued)

METERS—(Cont'd)

Pitot Tube.

American Blower Co., Detroit, Mich.

Steam.

American District Steam Co., No. Tonawanda, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.

MOTORS (Electric).

Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

OZONE APPARATUS.

Ozone Pure Airifier Co., Chicago, Ill.
United States Ozone Co., Scottdale, Pa.

PIPE.

Cast Iron.

Clow & Sons, Jas. B., Chicago, Ill.

Soil.

Simmons Co., John, 110 Center St., New York.

Steel.

National Tube Co., Pittsburgh, Pa.
Simmons Co., John, 110 Center St., New York.

Wrought Iron.

Simmons Co., John, 110 Center St. New York.

Wood.

Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.

Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Grinnell Company, Providence, R. I.
National Pipe Bending Co., New Haven, Conn.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, (Wood).

American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE HANGERS.

Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE, POWER.

Grinnell Company, Providence, R. I.
Simmons Co., John, New York.

PUMPS.

Centrifugal.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Condensation.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

Rotary.

Nash Engineering Co., So. Norwalk, Conn.

Steam.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.

Turbine.

Nash Engineering Co., So. Norwalk, Conn.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yoemans Bros., Chicago, Ill.

Vacuum

American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Chicago Pump Co., Chicago, Ill
Economy Pumping Machinery Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
McAlear Mfg. Co., Chicago, Ill
Nash Engineering Co., So. Norwalk, Conn.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Skidmore Corp., Chicago, Ill.
Trane Co., La Crosse, Wis.
Weinman Pump Mfg. Co., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros. Chicago, Ill.
Young Pump Co., Michigan City, Ind.

RADIATOR BUSHINGS

Metering

Holley Engineering Co., Virginia, Minn.

RADIATOR COVERS

Acme Radiator Shield Co., Cincinnati, Ohio.

RADIATOR HANGERS.

Farley Sleeve & Hanger Co., Cleveland, Ohio.
Gloeckle, Jr., A. F., Rochester, N. Y.
Grinnell Company, Providence, R. I.
Healy-Ruff Co. Minneapolis, Minn.
Pierce, Butler & Pierce Mfg. Co., New York.

RADIATORS

"Gasteam"

James B. Clow & Sons, Chicago, Ill.

"Gaswater."

Clow & Sons, Jas. B., Chicago, Ill.

RADIATORS, STEAM AND WATER.

Aerofin Corp., Newark, N. J.
American Radiator Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Gurney Heater Mfg. Co., Boston, Mass.
Lyon Products Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Simmons Co., John, New York.

RECEIVERS.

Air.

American District Steam Co., No. Tonawanda, N. Y.
The Brownell Co., Dayton, O.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.

Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago. Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Yeomans Bros., Chicago, Ill.

REGULATORS.

Boiler-Feed.

Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Thrush & Co., H. A., Peru, Ind.
Wright-Austin Co., Detroit. Mich.

Damper.

American Dist. Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago, Ill.
Bishop & Babcock Co., Cleveland, Ohio.
Davis Regulator Co., G. M., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Co., Chicago, Ill.
Nelson Co., H. W., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburgh, Va.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Thrush & Co., H. A., Peru, Ind.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

Pressure.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Foxboro Co., Inc., The Foxboro, Mass.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Taylor Instrument Cos., Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.

Temperature.

American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Carrier Engineering Corporation, Newark, N. J.
Elliott Co., Jeanette, Pa.
Foxboro Co., Inc., The Foxboro, Mass.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

SEPARATORS.

Oil.

Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Wright-Austin Co., Detroit, Mich.

Steam.

American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SPRAY COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Massachusetts Blower Co., Watertown, Mass.

SPRINKLERS.

Automatic.

C. S. B. Sprinkler Co., Boston, Mass.

STRAINERS.

Oil.

Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.

Steam

American Dist. Steam Co., No. Tonawanda N. Y.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeannette, Pa.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Mason Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Wright-Austin Co., Detroit, Mich.

Water

American Dist. Steam Co., No. Tonawanda N. Y.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sarco Co., New York.

THERMOMETERS.

(Recording and Indicating.)

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
Moto Meter Company, Inc., Long Island City, N. Y.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

Water

Marsh & Co., Jas. P., Chicago, Ill.
Pierce, Butler & Pierce Corp., New York.

THERMOSTATS.

American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Fulton Co., Knoxville, Tenn.
Johnson Service Co., Milwaukee, Wis
Klipfel Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Thrush & Co., H. A., Peru, Ind.

TRAPS.

Radiator.

Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dole Valve Co., Chicago, Ill.
Dunham, C. A., Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

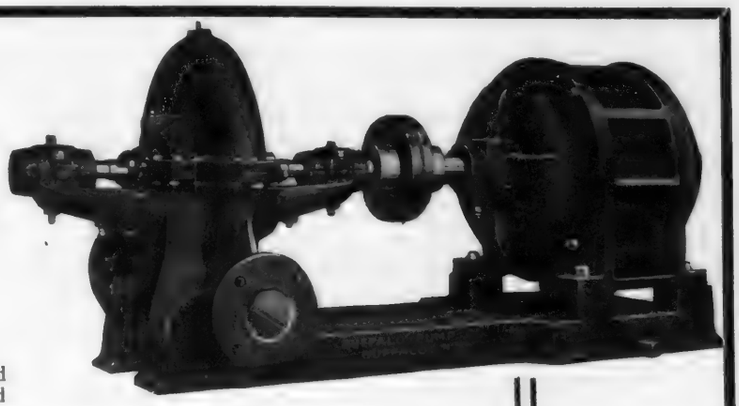
Return.

American Blower Co., Detroit, Mich.
Barnes & Jones, Boston, Mass.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

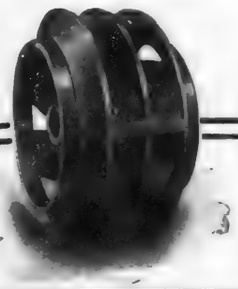
Steam.

American Blower Co., Detroit, Mich.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.

8 Reasons for Specifying "Buffalo" Class "S" Pumps–



1. **Casing:** Horizontally divided;—mounted directly on base. Interior can be inspected without breaking pipe connections.
2. **Impeller:** Enclosed double suction type, hydraulically balanced.
3. **Clearance Rings:** Brass. Furnished in casing. Easily renewable.
4. **Shaft Bearings:** Ring oiling, horizontally split housings. Brackets bolted to casing, one on each side.
5. **Thrust Bearings:** Collars in each bearing of smaller pumps, marine type on larger sizes.
6. **Stuffing Boxes:** Extra deep. Brass bushed in smaller sizes.
7. **Glands:** Bolted type.
8. **Water Seals:** Brass. Furnished in each stuffing box. Connections cast in casing in smaller sizes.



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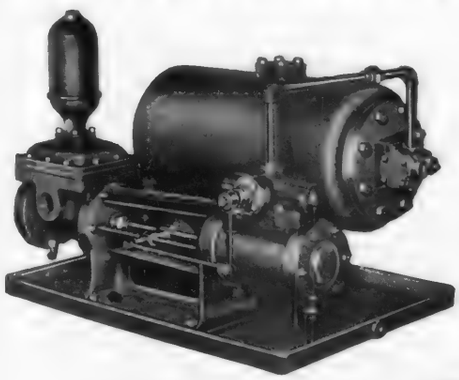

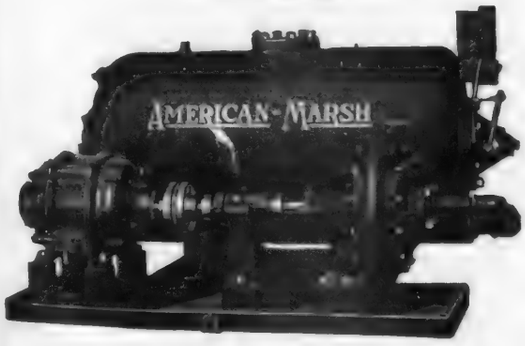

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Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.

Vacuum.

American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
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Hoffman Specialty Co., New York.
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Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES, (Steam).

Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

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Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son, A., Elmira, N. Y.

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Sturtevant Co., B. F., Hyde Park, Mass.

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Fulton Co., Knoxville, Tenn.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Pierce, Butler & Pierce Corp., New York.
Russell & Co., W. A., New York.
Simmons Co., John, New York.

Air Relief.

American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co , Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Russell & Co., W. A., New York.
Sterling Engineering Co., Milwaukee Wis.
Webster & Co., Warren, Camden, N. J.

Back Pressure.

Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
Stickle Steam Specialties Co., Indianapolis, Ind.

Balanced.

American District Steam Co., No. Tonawanda, N. Y.
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Davis Regulator Co., G. M., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.

Blow-off.

Elliott Co., Jeanette, Pa.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

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Jenkins Bros., New York.
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O-E Specialty Mfg. Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Float

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
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Davis Regulator Co., G. M., Chicago, Ill.
Grinnell Company, Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller Co., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.

Gate.

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Marsh Valve Co., Erie, Pa.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

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Dole Valve Co., Chicago, Ill.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Pierce, Butler & Pierce Corp., New York.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York

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Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

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Bishop & Babcock Co., Cleveland, Ohio.
Commonwealth Brass Corporation, Detroit, Mich.
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Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
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Trane Co., La Crosse, Wis.
Simmons Co., John, New York.
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Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Reducing.

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Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powell Co., Wm., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.

Regulating.

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Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.

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American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Jenkins Bros., New York.
Powell Co., Wm., Cincinnati, O.

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Peerless Unit Ventilating Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

(See also Heaters, Portable Unit Air.)

VENTILATING SYSTEMS.

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Atmospheric Conditioning Corp., Phila., Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
H. W. Nelson Co., Moline, Ill.
Nesbitt, John J., Inc., Atlantic City, N. J.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilating Co., New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

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Allen Air-Turbine Ventilator Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

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Knowles Mushroom Ventilator Co., New York.
Lyon Products Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

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Higgin Manufacturing Co., Newport, Ky.
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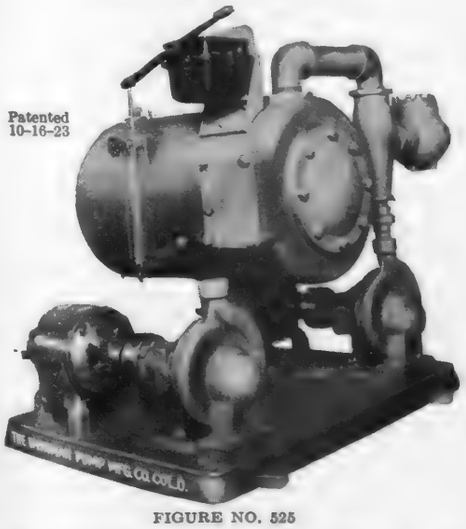

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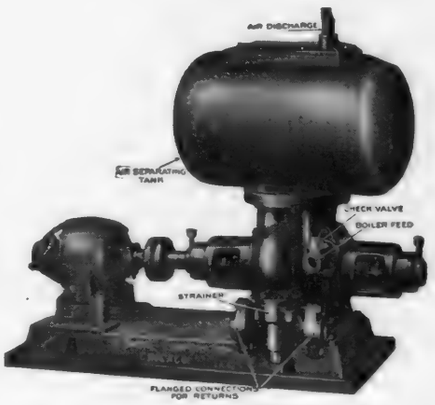

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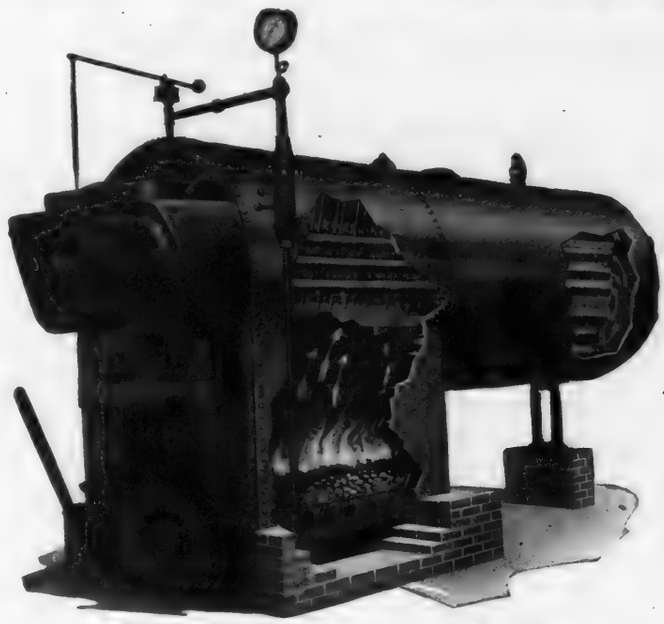

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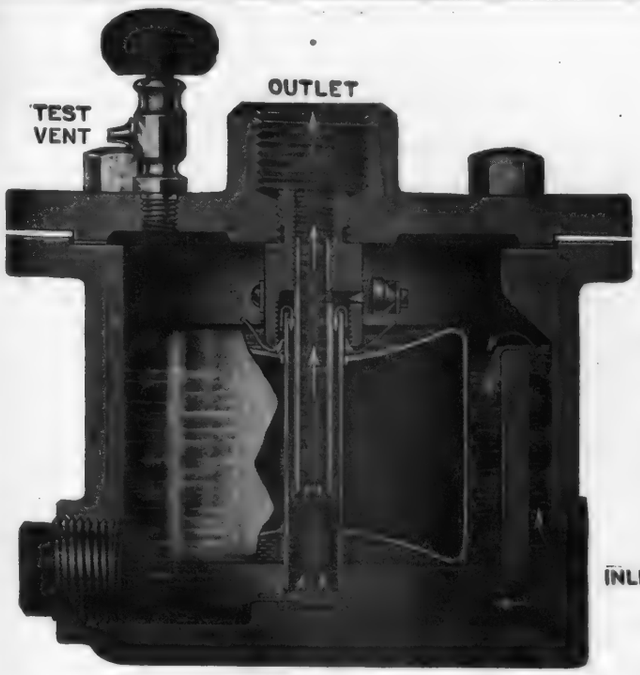


MARSH

DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

for direct or indirect coils or any location where large quantities of water are to be discharged

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

We Invite Correspondence

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

FOUNDED 1865

Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents Indicating and Recording Gauges

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

From Coast to Coast They Come to Waukegan for Boilers

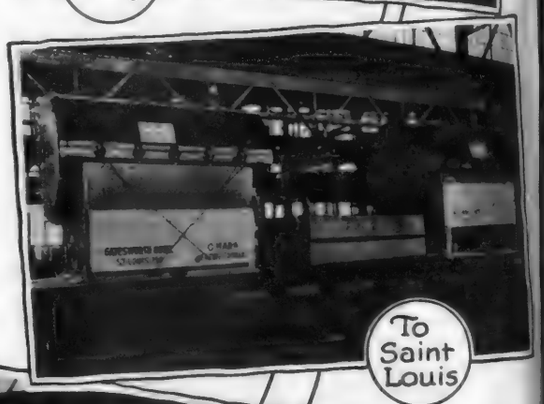
Why is it? Why do people come from all over the country to Waukegan for Pacific Boilers?

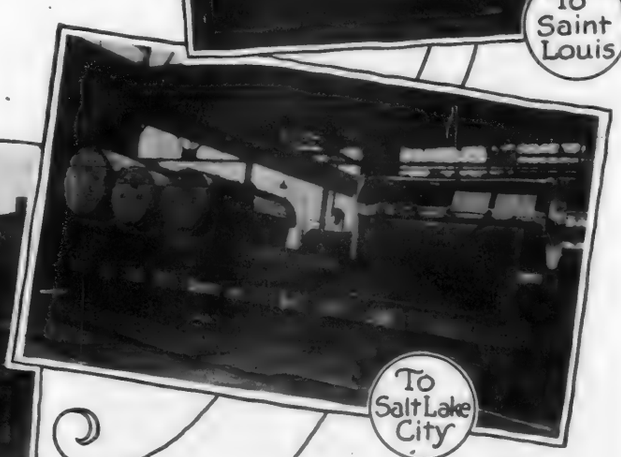
It's simply a matter of good business. They are after results based on the actual experience of thousands of building owners who have proved the efficiency and low operating cost of Pacific Boilers. If they could get boilers "just as good" hundreds and thousands of miles nearer home it's a sure thing they wouldn't come to Waukegan for heating equipment.

That is an obvious fact. And it's a significant fact, because it is a common practice for men who know to insist on Pacific Boilers.

Write today for illustrated bulletin.

GENERAL BOILERS CO.
Waukegan, Ill.
Sales Offices in All Principal Cities.





TRADE MARK REG. U.S. PAT. OFF.
STEEL HEATING BOILERS
PACIFIC

PACIFIC

STEEL HEATING BOILERS

KEWANEE

Says What It Does—
Does What It Says!

KEWANEE WATER HEATING GARBAGE BURNER

DESTROYS garbage and rubbish *without odor* and heats 200 to 2600 gallons of water per hour. Simply and durably built to the KEWANEE standard—made of *steel*, riveted. Functions every place where human beings live, work or play.

[The details are in our Catalog No. 75]

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CHARLOTTE, N. C.....135 Brevard Court
CHATTANOOGA, TENN.....1226 James Bldg.
CHICAGO, ILL.....822 W. Washington Blvd.
CINCINNATI, OHIO.....P. O. Box 75
CLEVELAND, OHIO, Superior Ave. N. E. at 17th St.
COLUMBUS, OHIO.....510 Comstock Bldg.
DALLAS, TEXAS.....809 Southwestern Life Bldg.
DENVER, COLO.....1226-1228 California St.
DES MOINES, IOWA.....315 Hubbell Bldg.
DETROIT, MICH.....1772 W. LaFayette Blvd.
EL PASO, TEXAS.....226 Mesa Ave.
GRAND RAPIDS, MICH. 402½ Mich. Trust Bldg.
INDIANAPOLIS, IND. 221 Indiana Terminal Warehouse
KANSAS CITY, MO.....2014 Wyandotte St.
LOS ANGELES, CALIF.....420 E. Third St.
MILWAUKEE, WIS. 835 Merchant's & Manufacturer's Bank Bldg.
MINNEAPOLIS, MINN.....708 Builders Ex. Bldg.
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ST. LOUIS, MO.....4200 Forest Park Blvd.
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SAN ANTONIO, TEXAS.....502 Calcasieu Bldg.
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SEATTLE, WASH.....Central Bldg.
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TOLEDO, OHIO.....1121-22 Nicholas Bldg.
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Gurney

Sectional Boilers
Another Type of the 900 Series
Steam and Water

No. 925 STEAM BOILER
Also for Water

The wide variance in sizes of the 900 Series of Gurney Sectional Boilers provides a type for every requirement, from the residence to the large installation requiring a battery of two or more boilers.

Another type of this Series is the No. 925 Steam Boiler (also for Water), slightly smaller than the 935 type, and being only 55 inches high, with a grate area of 6½ sq. ft. The same low water line meets requirements where head room is limited.

Gurney Sectional Boilers are built of highest grade pig iron, give long and continuous service and embody many exclusive advantages. Heating surfaces are well arranged, and cleaning is a simple matter. Steam boilers have liberal steam space.

Ample fuel and grate areas, large prime fire surfaces and unusual coal carrying capacity are features which help to make Gurney Sectional Boilers economical and satisfactory.

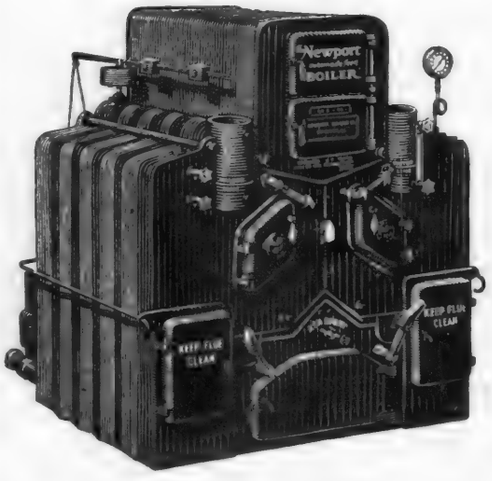
Send for Catalog

GURNEY HEATER M'F'G COMPANY.

General Offices:

New York 11 East 42d Street | Boston, Mass. 93-95 Oliver St., Fort Hill Square | Philadelphia 108 North 17th Street

ANNOUNCEMENT



Burns No. 1. Buckwheat to Stove Sizes of Coal.

During the many years of our business we have always held to an ideal of the highest standard of product at the lowest possible price.

That this policy has earned the confidence of those we have served is evident by the constant increase in volume of sales, with the result that a further reduction in price is possible at this time.

You may now furnish your clients with Newport Automatic Feed and Oil Burning Boilers at practically the same cost as ordinary boilers.

Our new plant with greatly increased production and improved manufacturing facilities, insures you the same high quality of product with better service and broader distribution.

Our engineering and sales departments are prepared to give you every cooperation.

Complete literature and prices upon request.

Newport Boiler Company
105 South Dearborn Street, Chicago, U.S.A.

New York Office: 101 Park Avenue

Wolff Draft Conditioners

Recommended, used and installed by leading Architects, Engineers, Contractors and Building Owners

Some of the biggest building owners in Chicago have installed Wolff Draft Conditioners on the boilers in every building they own. Chicago's famous Yellow Cab Company has installed them on the boilers in all their garages.

"Popular Mechanics" Building, 200 E. Ontario St., Chicago
Marshall & Fox, Chicago, *Architects*
Heated with Kewanee Boilers, equipped with
Wolff Draft Conditioners.

Leading Architects, Boiler Manufacturers, Heating Engineers and Contractors ***use and recommend them as the one fuel-saving device that has made good.***

They have learned that Wolff Draff Conditioners eliminate the human element in firing a boiler, and make it possible for even an unskilled man to get from a boiler the same high efficiency that the manufacturer himself gets when he operates his boiler as he knows it should be operated.

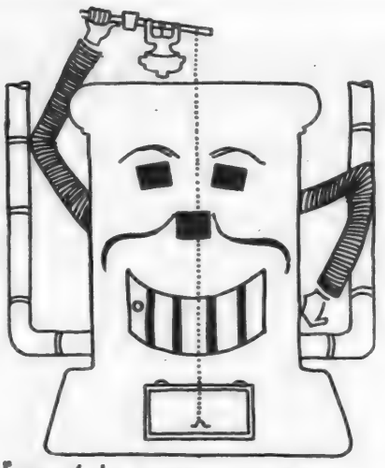
Write for our Red Book giving the facts.

HEATING CONTRACTORS
There is money for you in selling and installing
Wolff Draft Conditioners

SALES REPRESENTATIVES
We want a concern in every City, who calls on Architects, Owners and Contractors to take the Agency A good and profitable line.

Wolff Coal Saver Co.

1336 West Congress St. - - Chicago



"EASY! I'M WARM ENOUGH, SO I'LL JUST CLOSE THE DRAFTS!"

SELF-REGULATED

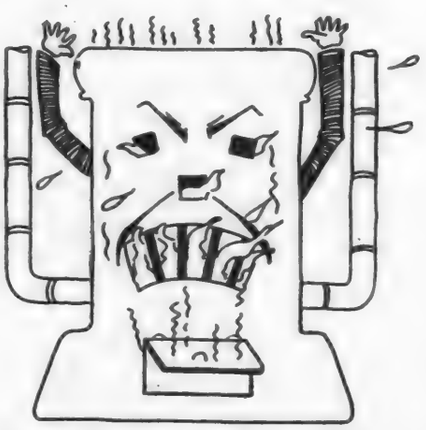
Thrush System

Because Thrush System is automatically regulated by the temperature of the water in the boiler, fires are under constant and positive control and uniform room temperatures are maintained. Therefore more heat—less fuel! The economies in operation and saving in attention required when Thrush System is installed on old or new plants will interest your customers.

Write for Catalog

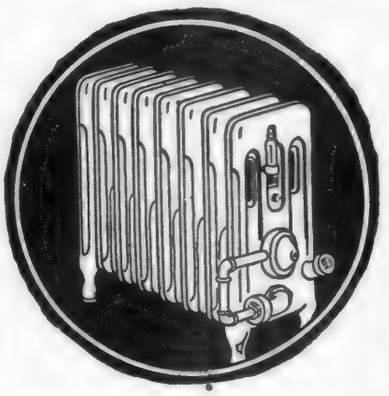
H. A. Thrush & Co.

PERU, IND.



"WHEW! I'M BURNING UP! IF SOMEBODY DON'T COME DOWN-STAIRS SOON, I'LL BLOW UP!"

Why Clow Gasteam is a more healthful kind of heat



Designed for the complete heating of old or new buildings — offices, stores, factories, schools, public buildings, residences, and apartments

EACH RADIATOR AN INDEPENDENT STEAM HEATING PLANT

Clow Gasteam heat is clean, pure and preserves the normal humidity of the air. The tiny Bunsen flames under the water chamber produce complete combustion and create a certain amount of moisture.

These flames cannot touch any surface, hence Clow Gasteam Radiators are free from the troubles sometimes occurring in merely supplementary heating appliances.

A Complete Heating System

Clow Gasteam is a system of individual steam radiators, each containing its own supply of water, which needs to be renewed only about every two weeks. It requires no connection with water piping. It cannot freeze or burn out.

To have heat, all that is necessary is to turn a valve and light. Clow Gasteam Radiators are automatically regulated to maintain an even steam pressure.

Clow Gasteam Radiators have been used for over twenty years, all over the country. If you are not familiar with Clow Gasteam, write us for additional information and for the names of users in your vicinity.

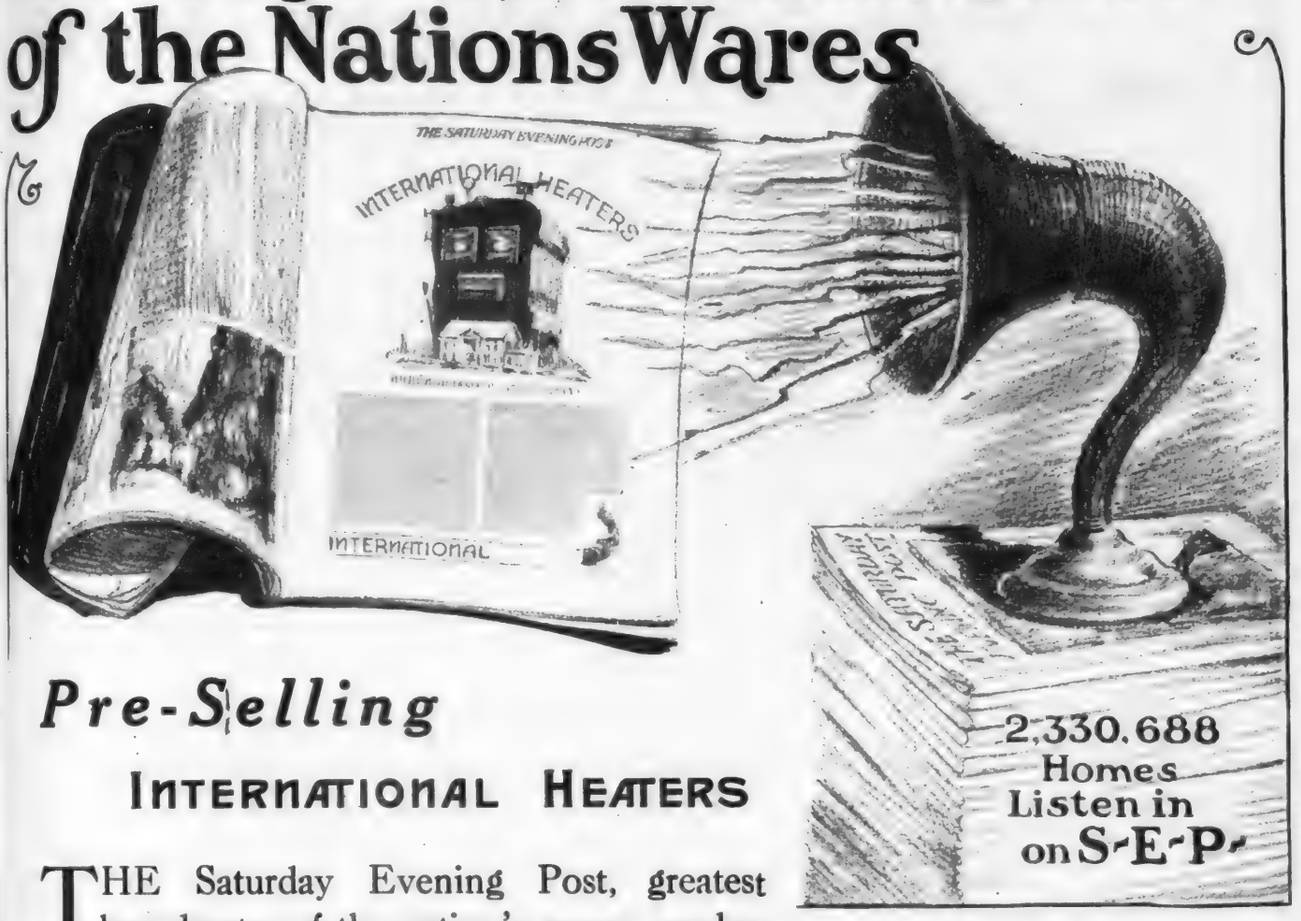
JAMES B. CLOW & SONS

534-546 So. Franklin Street

CHICAGO

CLOW "GASTEAM" HEATING SYSTEMS

the Supreme Broadcaster of the Nations Wares



Pre-Selling

INTERNATIONAL HEATERS

THE Saturday Evening Post, greatest broadcaster of the nation's wares, reaches a list of buyers selected according to their intelligence and buying power.

Check up the Post Circulation in your community and you will find that in practically every home where you could sell a heater the family is "listening in" on your advertising and ours.

Watch for our advertising in the March and succeeding issues of the Post, Country Gentleman and numerous other publications. Use our sales helps to increase your business on INTERNATIONAL Heaters.

Sales Helps For Your Use

Catalogs
Circulars
Mailing Folders
Movie Slides
Building Signs
Authorized Dealer Signs for Store and Truck
Newspaper Electros
Newspaper Copy
Sales Letters
Window Display
Store Cards
Hangers

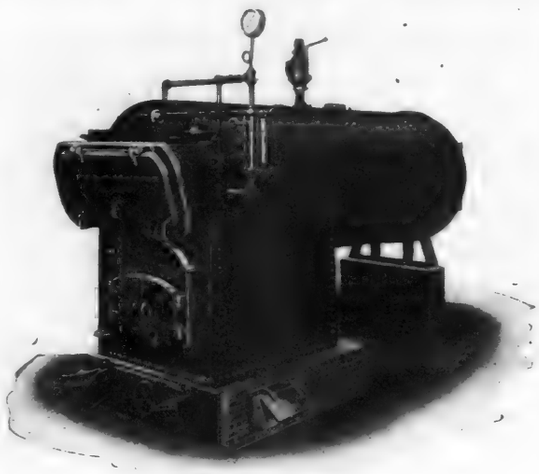
Send for samples and booklet telling how to merchandise INTERNATIONAL HEATERS

INTERNATIONAL HEATER COMPANY

UTICA, N. Y.

NEW YORK CHICAGO CLEVELAND DETROIT NASHUA, N. H.

AMES
Firebox Heating Boilers

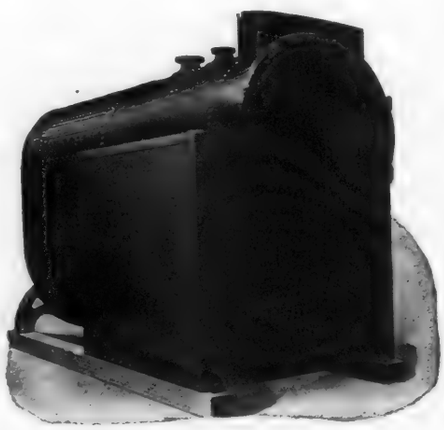


Ames Firebox Heating Boiler with Plain Furnace

Built with Plain and Downdraft Furnaces. Incorporating the Latest and Most Advanced Ideas in Boiler Design and Construction.

We also build a complete line of Horizontal Tubular, Upright and Empire Boilers for Heating and Power Requirements.

Bulletins with complete details mailed on request.



Empire Return Tubular Portable Boiler

AMES IRON WORKS
DIVISION OF
Pierce, Butler & Pierce Mfg. Corp.

Main Office & Works
Oswego, N. Y.

General Sales Office
41 E. 42nd St., New York City

What You Want!

A SINGLE PIPE VAPOR SYSTEM

Simple to Install

—Any steam fitter can put in this System

LOW IN COST

Does the Work

—We have the successful installations to prove it

Descriptive matter sent on request

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273 Congress St., Boston, Mass.

CHAS. A. MANN,
155 N. Clark St., Chicago, Ill.

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325 Ellicott Sq., Buffalo, N. Y.

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J. E. PERKINS CO.,
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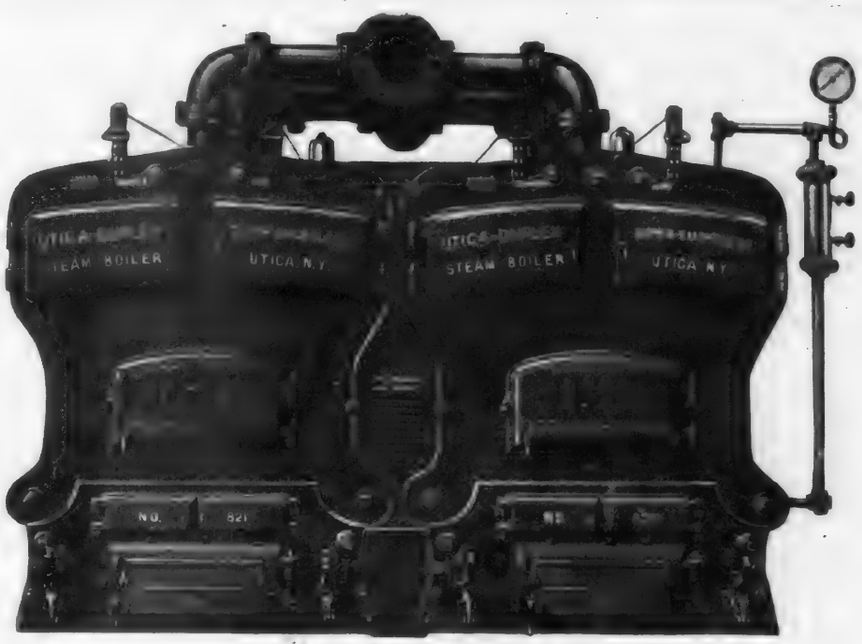
DUANE L. BLISS, JR.,
Rialto Bldg., San Francisco, Cal.

JOHN H. DODD,
1505 N. Haskell Ave., Dallas, Tex.



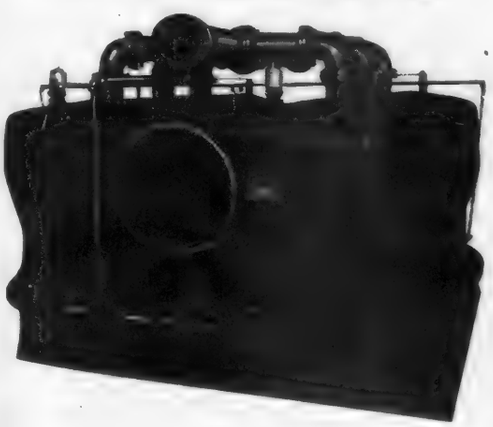
Front View of Utica-Duplex SUPER-SMOKELESS Boilers

UTICA-DUPLEX SUPER-SMOKELESS BOILERS

Announcing the New Duplex Boiler!

UTICA-DUPLEX SUPER-SMOKELESS Boilers have many advantages over the ordinary type of wide grate boilers. A double fire-box gives a greater amount of heating surface per square foot of grate area, and this surface is in direct contact with the fire. The header construction, which is shipped as an integral part of the boiler, assures large steam space. The individual grates require less attention and make possible a greater latitude in the fire required at different seasons of the year. One half of the boiler will operate as efficiently as a single boiler, the other half neither chilling the fire nor requiring wastage of coal to cover the unused portion of the grate. It is possible to shut down one half of the boiler for cleaning the grates or any other purpose. Precautions have been taken to equalize the boilers, and a steady water line is maintained at all times. Engineers and contractors are invited to write for complete information.

Rear View of Utica-Duplex SUPER-SMOKELESS Boiler Showing Header, Equalizer, Return Connections and Air Grates through which Supplementary Air is admitted to the Boiler.



Manufactured by the

UTICA HEATER COMPANY

UTICA, N. Y.

CHICAGO CLEVELAND NEW YORK

Sales Offices in the Principal Centers

INSTANT HOT WATER
WITH
DALQUIST AQUATHERM COPPER RANGE BOILER

The first improvement in range boiler construction in many years provides instant hot water to the consumer at minimum cost.

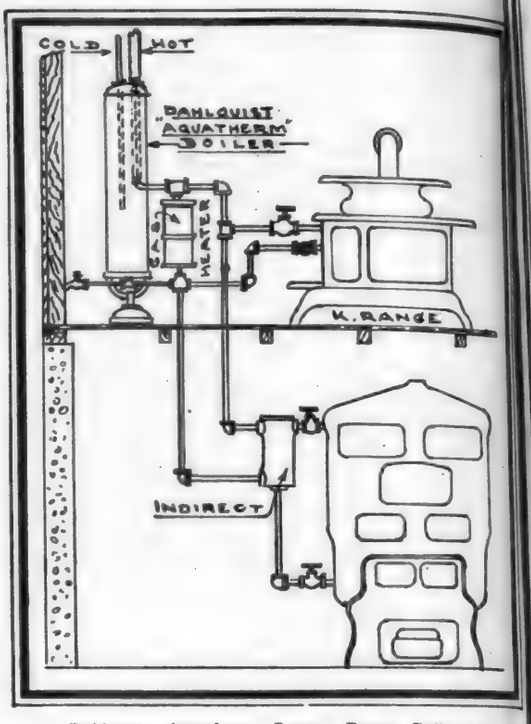
The Dahlquist Aquatherm Copper Range Boiler will reduce by one-half the cost of installing a gas tank heater on any job and will provide all the convenience of an instantaneous heater either from the ordinary gas tank heater, water back in coal range, indirect heater or coil in boiler or furnace, or electric heater. Range boiler acts as storage heater when hot water is not being used.

The Dahlquist Aquatherm can also be furnished separately to be installed in range boiler now in use whether heated by gas, coal, wood or electricity.

Let us send full details.

DAHLQUIST MFG. CO.,

40 WEST 3rd STREET, BOSTON, MASS.



Dahlquist Aquatherm Copper Range Boiler installed in connection with gas tank water heater, water back in coal or wood kitchen range in kitchen, and indirect water heater in cellar.

DON'T BURN UP YOUR MONEY

REDUCE COAL BILLS

BY INSTALLING

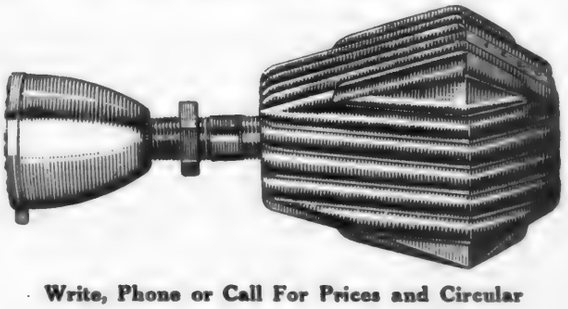
Manufacturer's Certified Ratings

Average Reductions of Coal:

10-20% on High Pressure Steam
15-40% on Low Pressure Steam
25-45% on Hot Water Heating
25-35% on Hot Air Heating

Burnrite Combustion Devices

Simple to Install
Automatic in Operation
No Upkeep Expense
No Regulation
Years of Service



Adapted to Steam Hot Water or Hot Air Plants — Industrial Plants — High Pressure

Makes Money for you and your customer.

Write, Phone or Call For Prices and Circular

JOHN SIMMONS CO

110 CENTRE STREET - - - - - - - - - - NEW YORK

WHERE conditions demand the installation of a boiler that will burn—smokelessly and economically—all grades of soft or hard coal and fuel oil, the logical choice of the engineer and heating contractor is the

Page Monarch Smokeless

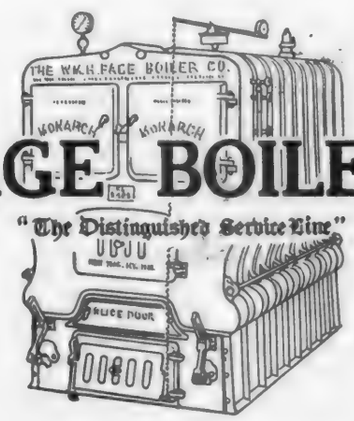
No. S-40-12
Monarch

Careful study of installations, demonstrating beyond question exceptional efficiency, and durability has convinced them of the superiority of the Page construction.

Simple in design—easy to operate Made in both push nipple and header types.

Prompt shipment from convenient shipping centers.

Contractors: Send for reduced price list, effective February 1st.



PAGE BOILERS

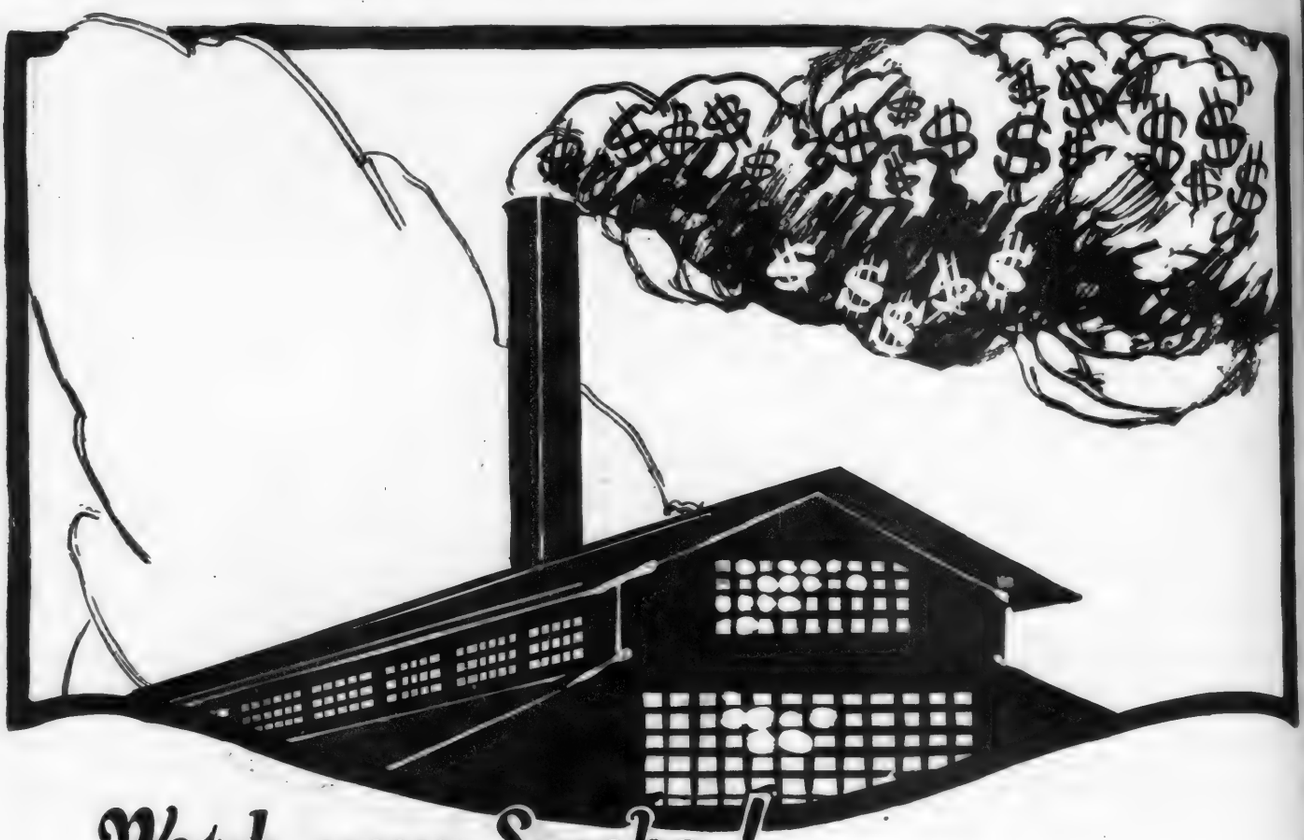
THE WM. H. PAGE BOILER CO.

58 West 40th Street
New York

BOSTON CLEVELAND
PHILADELPHIA MEADVILLE

Established 1856 *Incorporated 1877*

For All Fuels—Hard or Soft Coal, Gas or Oil



Watch your Smoke!

Specially constructed for bituminous coal. Will also burn anthracite without alteration.

Large firing doors. Direct and return tubes easily accessible for cleaning.

All steel construction to A.S.M.E. Code requirements.

Catalog No. 85A gives you complete details.

TICO smokeless
DOWN DRAFT RETURN TUBULAR FIRE BOX
BOILERS

The
TITUSVILLE IRON WORKS CO.

Titusville, Penna.

SALES OFFICES:

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Chicago, Ill.
53 West Jackson Blvd.

NATIONAL HORIZONTAL SUPER-HEATER

MULTI-RADIATOR TYPE

SCIENTIFICALLY DESIGNED FOR FAN BLAST SYSTEM OF HEATING AND VENTILATING

A DIRECT FIRED HEATING UNIT THAT HEATS 10,000 CUBIC FEET PER MINUTE FROM—20° TO 120°+ AT A RATE OF EFFICIENCY THAT DEFIES COMPARISONS

HEATING ~ VENTILATING ~ DRYING

BURNS COAL—WOOD—OIL

HUNDREDS OF THESE NATIONAL SYSTEMS INSTALLED THROUGH OUT THE COUNTRY IN SCHOOLS, CHURCHES, THEATRES AND INDUSTRIAL PLANTS ARE SERVING OWNERS AND THE PUBLIC, AND WE HAVE TESTIMONIALS OF THEIR HIGH EFFICIENCY AND LOW MAINTENANCE COSTS

WRITE TO-DAY FOR INTERESTING BOOKLET ON THIS MASSIVE HEATER

WAUSAU VOCATIONAL SCHOOL
WAUSAU, WIS.
EQUIPPED WITH THE
NATIONAL SYSTEM
80,000 CUBIC FEET PER MINUTE OF FRESH WARM AIR

P. H. MAGIRL
FOUNDRY AND FURNACE WORKS
BLOOMINGTON, ILL.

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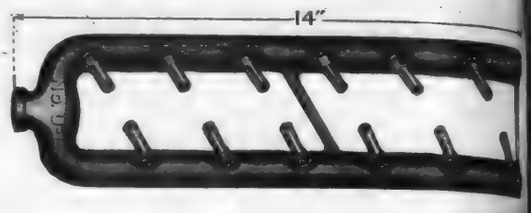
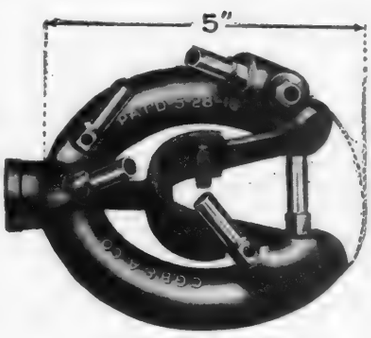
No. K-10



No. U-10

No. Z-10



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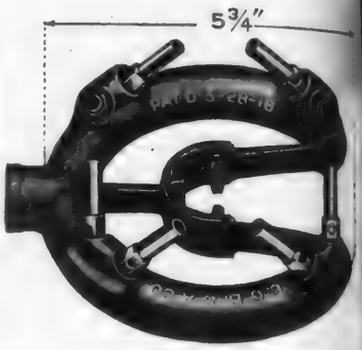

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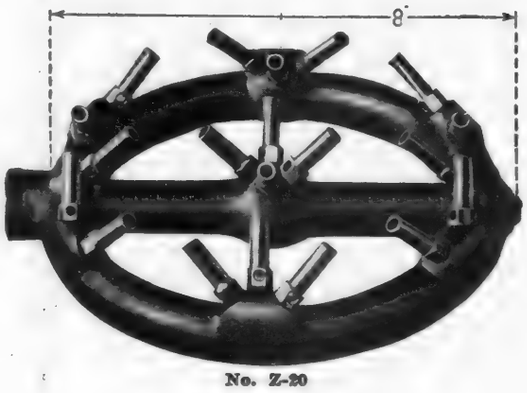

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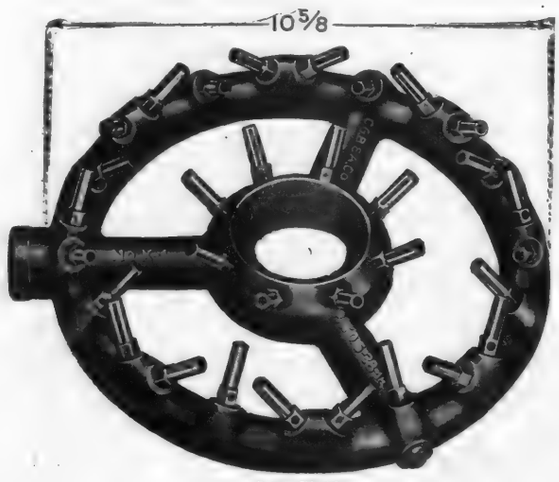


No. X-10

No heater is better than its burner and without an efficient burner no appliance stands the test—that's why the leading Manufacturers of Hot Water Heaters, Gas Boilers and Heating Appliances are adopted as Standard

BARBER Patented GAS BURNERS

There are ten sound reasons why they are far the most perfect on the market.

1. *Will reduce gas bills 25 to 40%.*
2. *Render the pilot light unnecessary.*
3. *Can be controlled with any good thermostat.*
4. *Will not back-fire or deposit carbon—upon any gas pressure.*
5. *Will develop a flame temperature of 1960 degrees Fahr. with 500 Btu. gas.*
6. *Requires no adjustment, regardless of pressures or quality of gas.*
7. *Jets or orifices cannot become corroded or clogged, or affected by condensation.*
8. *Will produce a perfect orange-green flame with Artificial, Natural or Mixed Gas.*
9. *Are the result of over six years' careful development by Gas Burner Specialists.*
10. *Have been adopted by leading Heater and Gas Appliance Manufacturers.*

Barber Patented Jet Burners are ideal for Hot Water Heaters, Small Steam Boilers, Furnaces, Liquid and Metal Pots, Candy and Doughnut Stoves, and Similar Appliances.

Why not write us today and let us assist in solving your gas burner problems. You will not be obligated in the least.

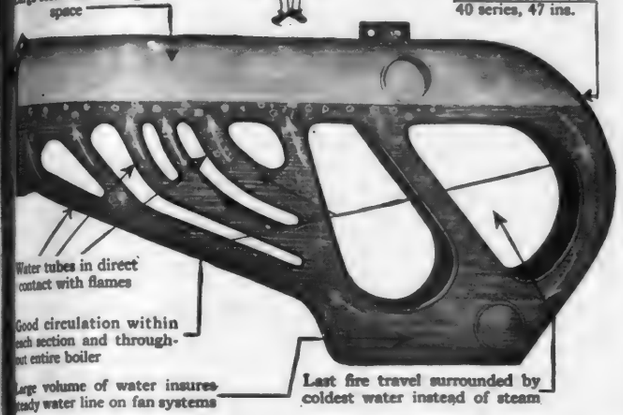
The CLEVELAND GAS BURNER & APPLIANCE CO.

Burner Specialists

3702-04 Superior Avenue, Cleveland, Ohio

Continental

BOILERS RADIATORS


Large steam liberating space
Low water line 30 series, 43 ins.; 40 series, 47 ins.
Water tubes in direct contact with flames
Good circulation within each section and throughout entire boiler
Large volume of water insures steady water line on fan systems
Last fire travel surrounded by coldest water instead of steam

Why the Low Continental 43 in. and 47 in. Water Lines Are Steady

THE water tube design of the Continental Low Water Line Boiler combines well balanced circulation with ample water capacity.

Large water content and balanced circulation prevent priming even on fan systems.

The unusually low water line provides ample space between lowest point of main and water line.

Continental Low Water Line Boilers are easy to fire. They are made in regular and smokeless types. They burn any kind of fuel, including oil.

30 Series Boilers 43 inch Water Line
1200 to 8200 sq. ft. steam capacity
40 Series Boilers 47 inch Water Line
2500 to 22,300 sq. ft. steam capacity

Continental Heater Corporation
Dunkirk, N. Y., U.S.A.

It's good business to ask 'em to buy Continental Boilers and Radiators. This book tells why.

Built for better heating

How Many Homes in Your Town have *worn-out* Heaters?

Replace them with THATCHER ROUND BOILERS

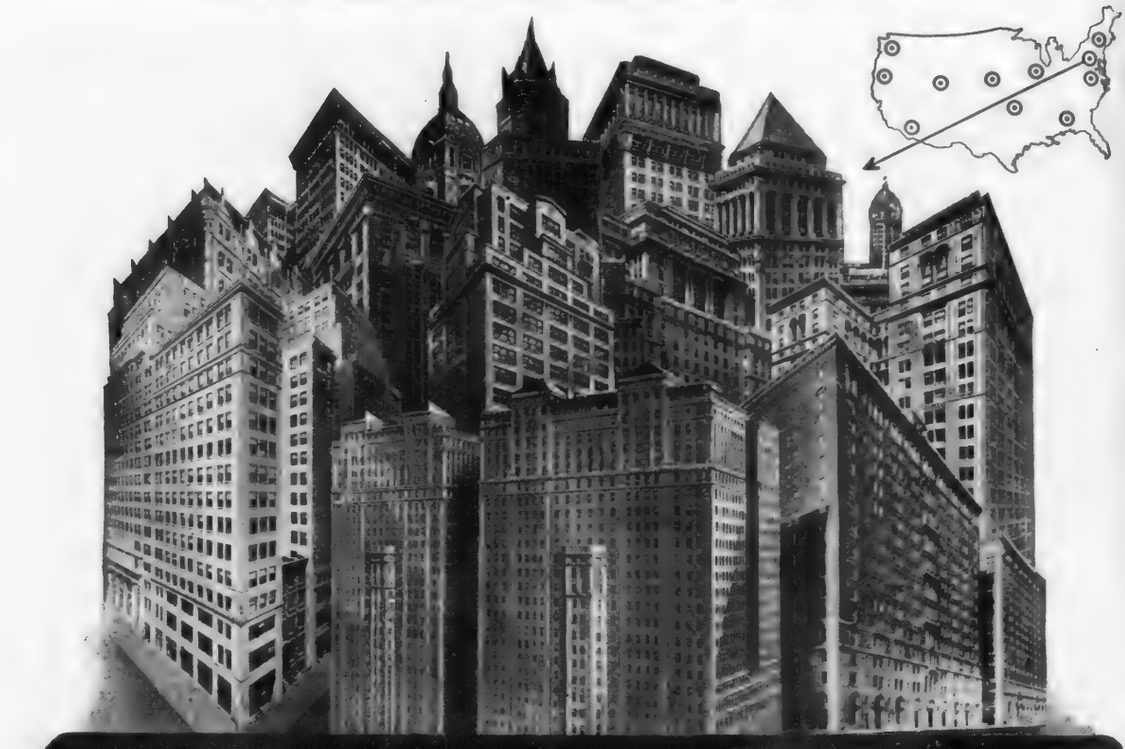
WHEN you tell owners of old-fashioned heaters that a Thatcher Round Boiler saves almost enough coal to pay for itself the first year or so, they will realize they've been wasting money on maintaining their old, inefficient heaters. Show them exactly why a Thatcher Round Boiler cuts fuel bills. Show them the special "Staggered fire" travel, the extra heating surfaces, the coal saving triangular revolving grates, and the high ash pit. Make "quick fire" sales by pointing out that the Thatcher is easy to operate and control and keeps the house cozy day and night in all weathers.

THE THATCHER COMPANY

Formerly Thatcher Furnace Co.
Since 1850

133-135 W. 35th St. New York City
39-41 St. Francis St. NEWARK, N. J.
341 N. Clark St. Chicago, Ill.

THATCHER
BOILERS-FURNACES-RANGES



NATIONAL

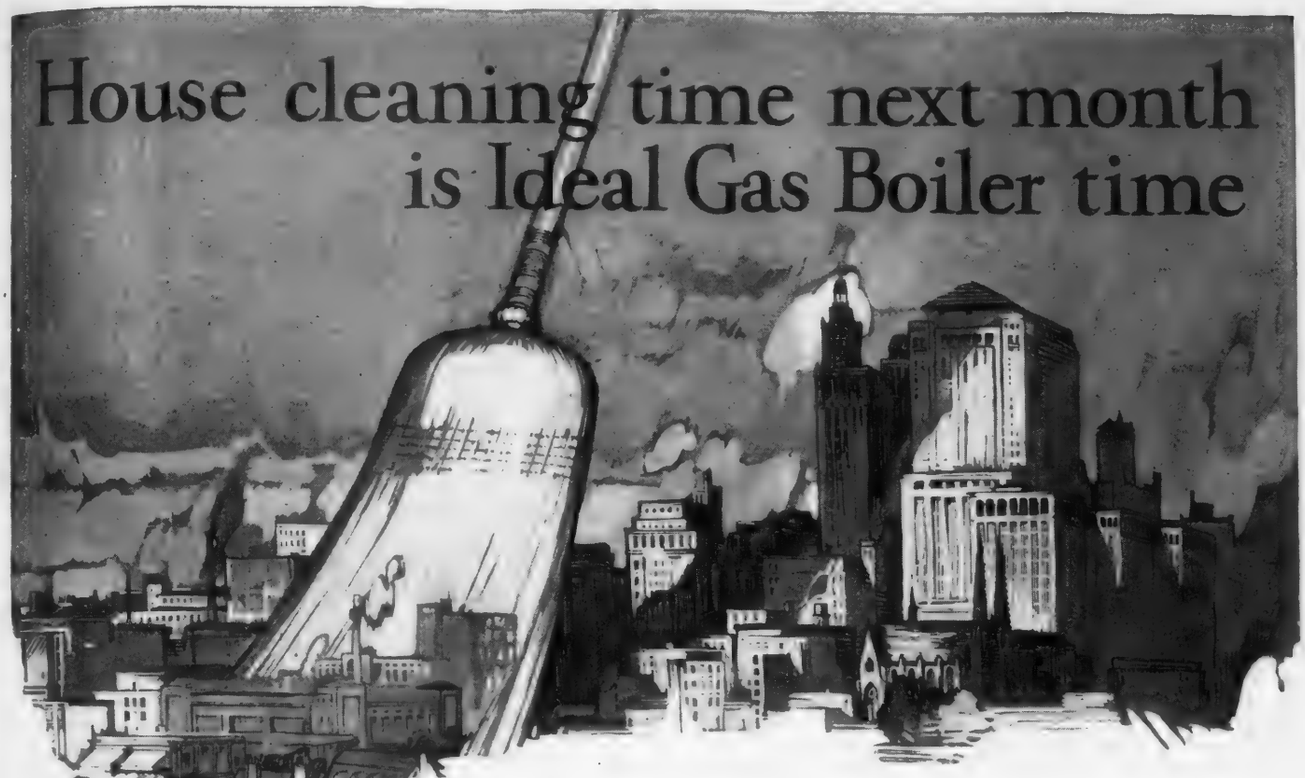
In New York

The Pipe Basis for Modern Building

OTHER cities may lay claim to the largest, finest, or most costly building of its kind, but the City of New York holds the distinction of having the greatest collection of large buildings of any city in the world. While she has always been proud of her architectural triumphs, she has been none the less proud of the substantial character of these structures, and particularly of the materials which have gone into them. A cross section of New York's finest will show a generous use of "NATIONAL" Pipe for both heating and plumbing and also for other purposes. The buildings illustrated are taken from Bulletin No. 25—"NATIONAL" Pipe in Large Buildings. This publication contains useful data on pipe for building purposes. A copy will be sent upon request.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

DISTRICT SALES OFFICES IN THE LARGER CITIES

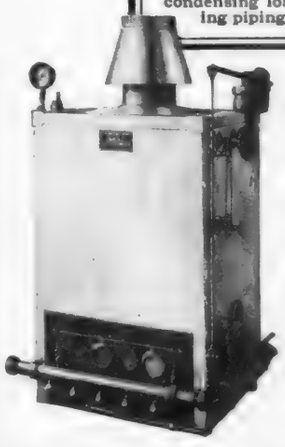


House cleaning time next month is Ideal Gas Boiler time

IDEAL Gas Boilers are clean, automatic, noiseless in operation, and beautiful in their polished aluminum insulated jackets.

Combustion is perfect, the design amazingly efficient. Over 85% of the total heat is absorbed in ⅛ second—about 30 inches of flue travel.

Ideal Gas Boilers are rated on A. G. A. Code; thus, the boiler capacity selected need be only 25% in excess of the total condensing load (including piping).



AMERICAN HOMES are dirty in the Spring largely because they're kept warm in the winter.

But every year there are more and more wise home owners who figure their heating expense as cost of fuel and attendance, plus their annual redecorating and cleaning—and put in an IDEAL Gas Boiler, which stores no fuel and needs no attendance from Fall to Spring.

You, too, can sell IDEAL Gas Boilers by co-operating with your gas company. They are your Gas Boiler jobbers! They assume the responsibility for service and back-call work. What other non-coal-burning installation approaches that for a quick, clean, satisfactory piece of business?

Why not write to us now or talk this over with your gas company? There are good profits in team-work—and even more of them in factories and buildings than in homes.

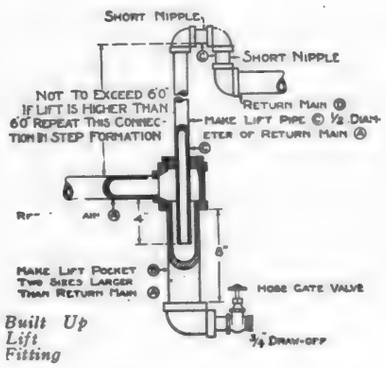
The A. H. Wolff Gas Radiator Co.

Distributors

376 Lafayette Street New York City

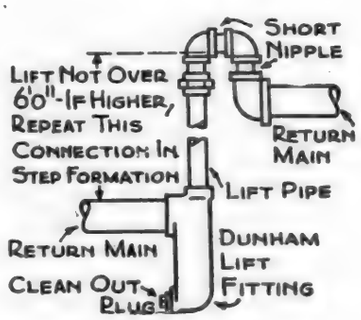
Lift Fittings—Their Use

DESIGN the system so that lift fittings will not be required on steam mains, endeavoring always to have all returns and drips flow by gravity to the vacuum pump. A lift fitting, however, at the pump generally functions satisfactorily if designed correctly.


SHORT NIPPLE
SHORT NIPPLE
NOT TO EXCEED 6'0" IF LIFT IS HIGHER THAN 6'0" REPEAT THIS CONNECTION IN STEP FORMATION
RETURN MAIN B
MAKE LIFT PIPE C ½ DIAMETER OF RETURN MAIN A
MAKE LIFT POCKET TWO SIZES LARGER THAN RETURN MAIN A
HOSE GATE VALVE
¾" DRAW-OFF

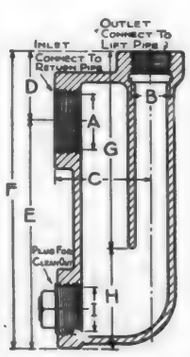
Built Up Lift Fitting

We join the Engineer in cautioning the steam fitter against using lift fittings on steam mains, as their use often produces water hammer when steam is turned into the system and when firing up a cold system. It must be remembered also where lifts are present the vacuum pump must be continuously in operation or circulation is stopped.



Lift Connection in Return Main

Due to building construction, lift fittings sometimes become necessary. In such cases the fitting should be designed with extreme care. The illustration shows a connection built up of pipe and fittings for use on large return piping. On smaller piping—¾" to 2" inclusive—the Dunham Lift Fitting will eliminate uncertain design and save the fitter's time of building up the unit. It is a one piece cast iron unit, fitted with plug for clean out.



The Dunham Lift Fitting

C. A. DUNHAM CO.

230 East Ohio St. Chicago

Over sixty branch and local sales offices in the United States and Canada bring Dunham Heating Service as close to your office as your telephone. Consult your telephone directory for the address of our office in your city.

The DUNHAM REG. TRADE MARK HEATING SERVICE

Bryant Co-operates

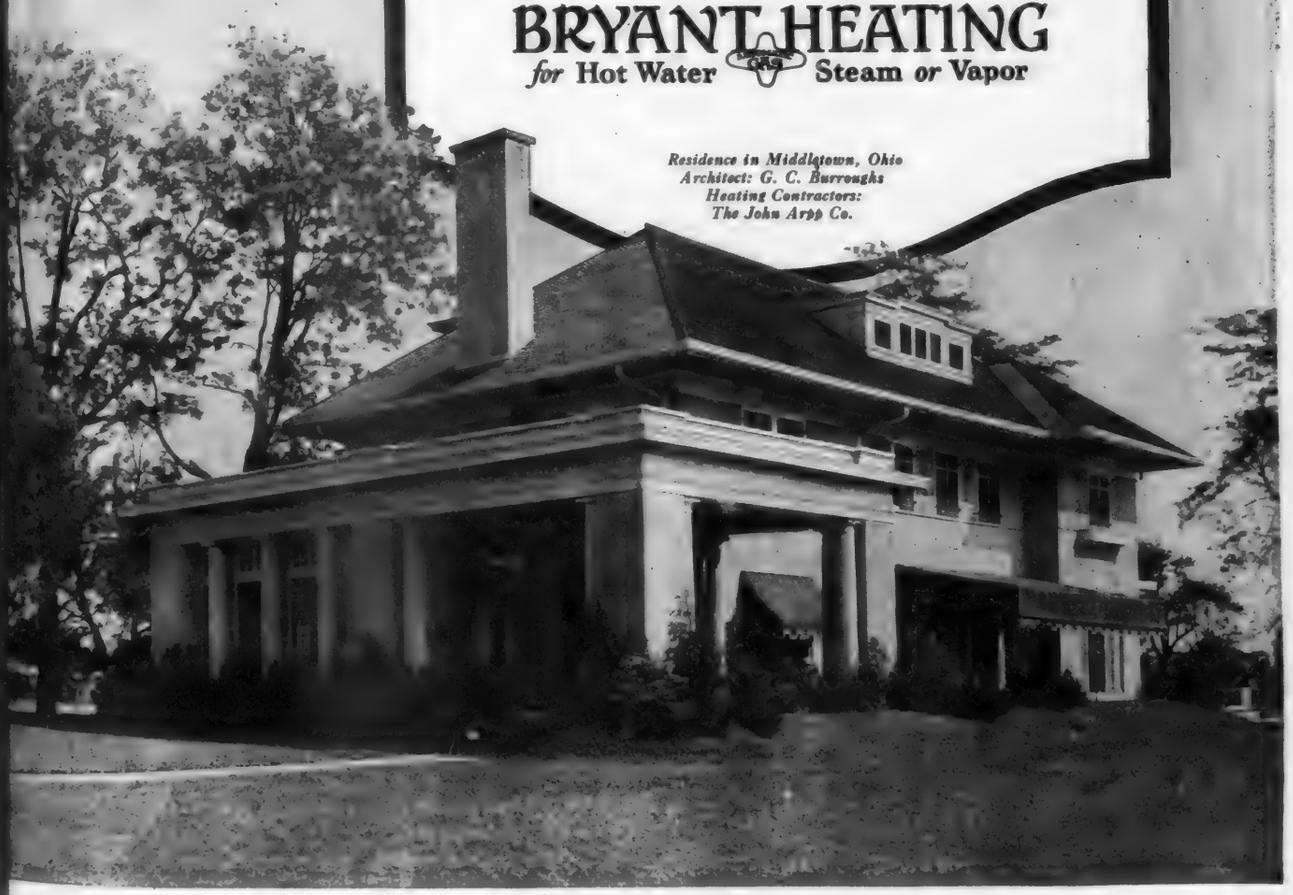
Gas for househeating offers a remarkably fertile field for healthy profits. An excellent gas boiler, backed up by a nation-wide organization which really strives to give you the utmost co-operation, makes it well worth-while to give Bryant Automatic Gas Heating intensive sales-support.

THE BRYANT HEATER & MANUFACTURING COMPANY
954 East 72nd St., Cleveland, Ohio

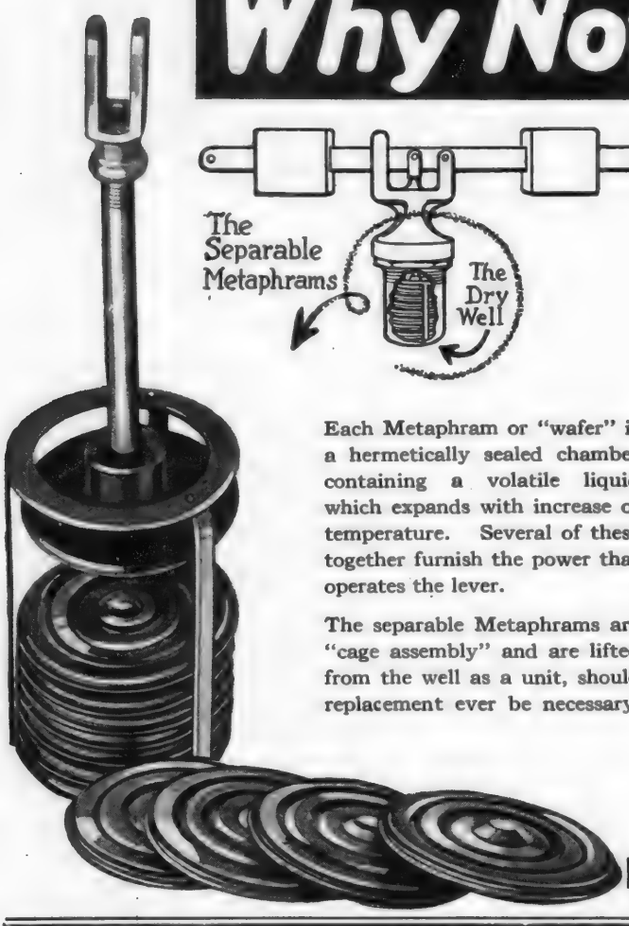
Branches in Principal Cities

BRYANT HEATING
for Hot Water — Steam *or* Vapor

Residence in Middletown, Ohio
Architect: G. C. Burroughs
Heating Contractors:
The John Arpp Co.



Why Not Hot Water



Each Metaphram or "wafer" is a hermetically sealed chamber containing a volatile liquid which expands with increase of temperature. Several of these together furnish the power that operates the lever.

The separable Metaphrams are "cage assembly" and are lifted from the well as a unit, should replacement ever be necessary.

A regulator is standard trimming on a steam boiler. Why not on hot water?

A steam installation would not be complete without a regulator. Everyone knows that.

Then why should you omit it on a hot water job? It's just as important for economical operation.

You can make hot water installations more profitable, more efficient and more satisfactory by adding a

METAPHRAM DAMPER REGULATOR

There is a fertile field for you, selling and installing this sensitive but positive, much needed regulator—on new or old installations.

Order from your jobber or direct.

Write for circular.

NATIONAL REGULATOR CO.
2301 KNOX AVENUE CHICAGO

European Office: A. J. Assheton, 18 St. Thomas St., London, S.E.1, Eng.

—"thoroughly pleased with the system."

Mr. H. R. Wagner, Contractor, of Hagerstown, Md., installed the O-E Vapor Vacuum pressure Heating System in the Williamsport High School:

He tells us in a letter that the system is responsive, economical, and efficient in every way, and that he appreciates its extreme simplicity and the absence of the possibility of any trouble.

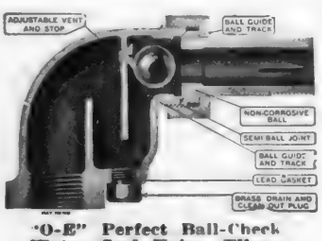
He also says that the architect and school board are "thoroughly pleased with the system," and that they will not consider any more straight steam jobs.

There are many other buildings like this one satisfactorily O-E heated. Let us send you some interesting data on recent tests.

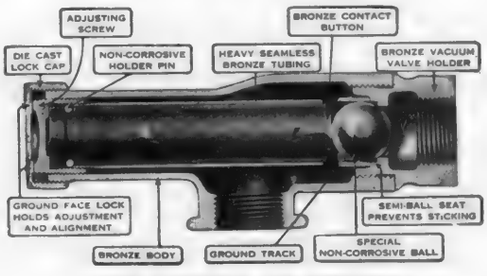
Williamsport High School

O-E SPECIALTY MFG. CO.

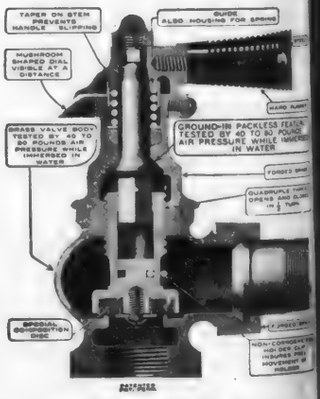
12 KEEFE AVENUE – – – MILWAUKEE, WIS



"O-E" Perfect Ball-Check Water Seal Union Elbow with Adjustable Air Vent.



"O-E" Improved Air Exhauster and Vacuum Valve


TAPER ON STEM PREVENTS HANDLE SLIPPING
GUIDE ALSO HOUSING FOR SPRING
MUSHROOM SHAPED DISC VIBRATES A DISTANCE
GROUND-IN PACKLESS FEATURE TESTED BY 40 TO 80 POUNDS AIR PRESSURE WHILE IMMERSED IN WATER
BRASS VALVE BODY TESTED BY 40 TO 80 POUNDS AIR PRESSURE WHILE IMMERSED IN WATER
FORGED BRASS
QUADRUPLE THREAD OPENS AND CLOSES IN ¼ TURN
SPECIAL COMPOSITION DISC
NON-CORROSIVE HOLDER PIN MOVEMENT OF HOLDER

"O-E" Improved Perfect Packless Graduated Valve

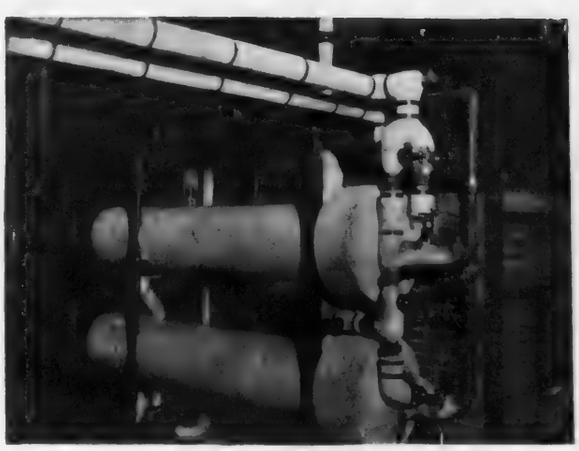
A Correction!

The Whitlock advertisement in the January issue of this magazine bore the caption "Harvard University Swimming Pool is Whitlock Heated."

This is an error which we wish to correct. While there is no swimming pool in this group of buildings, there are two Whitlock Heater installations of considerable size.

We believe the truth about these installations is of sufficient interest to warrant this second appearance of these illustrations.

A single power house serves to furnish heat and power to the entire group of buildings connected with the Harvard Medical School shown above. This group includes the Peter Bent Brigham Hospital and the Children's Hospital as well as several smaller buildings.



The Whitlock Type R Oil Heaters shown in the lower illustration are each capable of heating 4000 pounds per hour of 14 degree Baume fuel oil from 90° to 260° with steam at 110 pounds gauge pressure.

The Whitlock Converters shown in the upper installation cut supply hot water for the heating systems of one half this entire group of buildings. The rest of the buildings are steam heated.

We are justly proud of this installation of Whitlock Heaters in a justly famous institution. In like manner Whitlock Products are proving the correct solution of knotty Heat Transfer problems the world over.

Whitlock Engineers have gained a vast amount of valuable practical experience in the thirty years and more we have manufactured heaters. They are prepared to help you with your problem—what is it?

THE WHITLOCK COIL PIPE CO.

40 South Street :: :: **Hartford, Conn.**

New York Chicago Boston Buffalo Philadelphia San Francisco

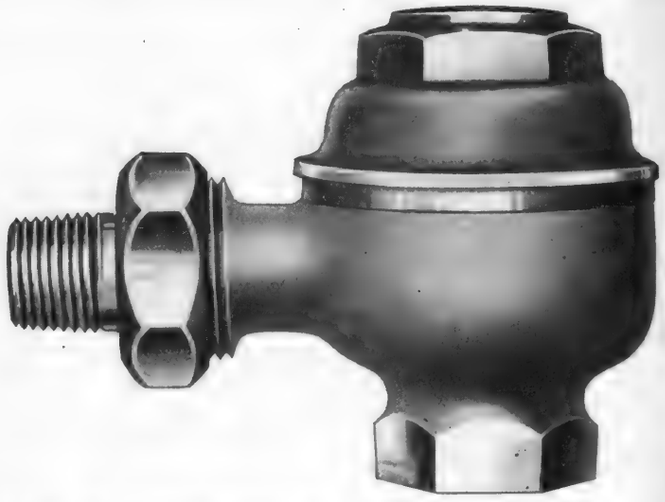
WHITLOCK HEAT TRANSFER PRODUCTS

Whitlock Heaters are manufactured in Canada by Darling Bros., Ltd., Montreal

THE

W.D. CASHIN CO.
THERMOFLEX

No. 3 RADIATOR TRAP



One of our Complete Line of Specialties for Vapor and Vacuum Heating Systems

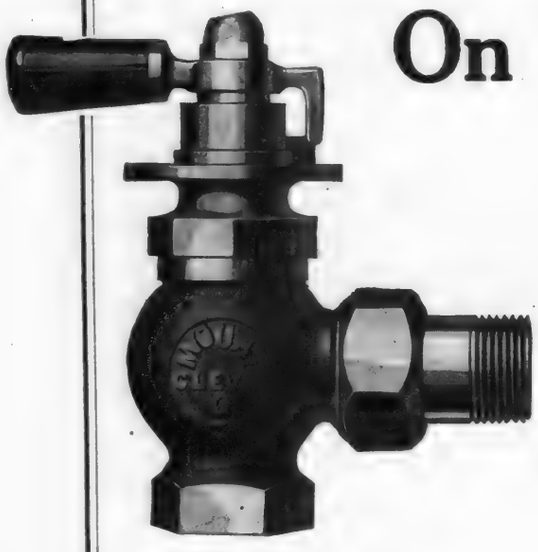
Diaphragm is our one-piece Thermoflex Bellows and embodies all the latest features in design and construction to make a thermostatic radiator trap long lasting and efficient.

Complete Bulletin Catalog mailed if requested

MANUFACTURED BY

W. D. CASHIN COMPANY

35 HARTFORD STREET :-: :-: :-: BOSTON, MASS



On 1 to 2 oz. Pressure

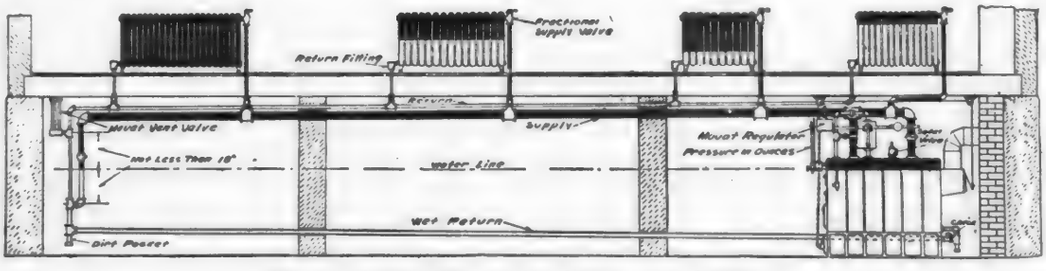
The Mouat System of Heating, a two-pipe gravity vapor or atmospheric steam heating system, operates at from 1 to 2 ounces pressure. No pumps, thermostatic valves, return traps or mechanically operated parts.

Shaded portions of the radiators in diagram below show how heat in radiators can be graduated or controlled, as desired, by the supply valves.

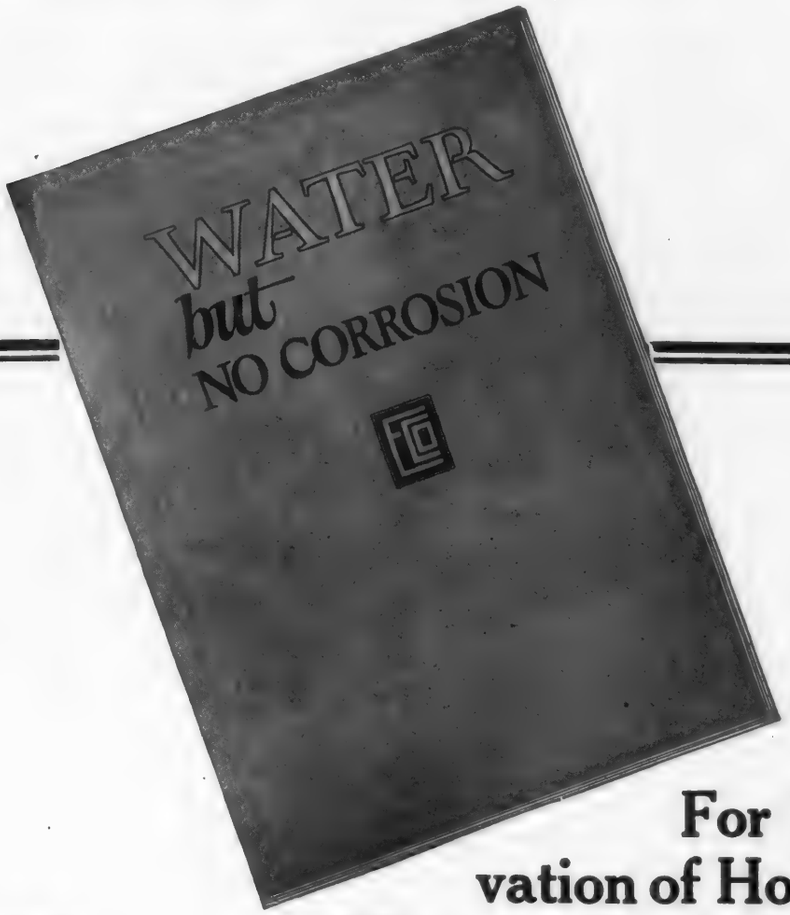
The control of the heat at the radiators, sensitive regulation of boilers and extremely low operating pressure make the Mouat an unusually economical system.

Send for detailed information.

MOUAT VAPOR HEATING COMPANY
CLEVELAND, OHIO



Showing how the Heat can be Graduated or Controlled



For the Salvation of Hot Water Piping—Read this Book

The solution of the corrosion problem lies not in trying to find a metal which will resist corrosion, but in taking out of the water the elements which cause corrosion. Elliott De-aerators and De-activators are positive means to this end.

It discusses the cause of corrosion of hot water piping in buildings. It illustrates specimens of corrosive attack on both ferrous and non-ferrous pipe material. It locates the reason for corrosion, and points out a remedy in the removing of dissolved oxygen from the water.

You will be interested in the description of the simple de-activating and de-aerating apparatus which will completely insure hot water piping against attacks from corrosion.

In the interest of hot water piping systems, an investment certainly worth protecting, you will want a copy of this book. The coupon is for your convenience.

ELLIOTT COMPANY
PITTSBURGH, PA.
General Offices: Jeannette, Pa.

District Sales and Service Offices: Atlanta, Baltimore, Boston, Chicago, Cincinnati, Cleveland, Detroit, Kansas City, Philadelphia, Pittsburgh, New York and St. Louis.

ELLIOTT
De-oxygen-ating Apparatus

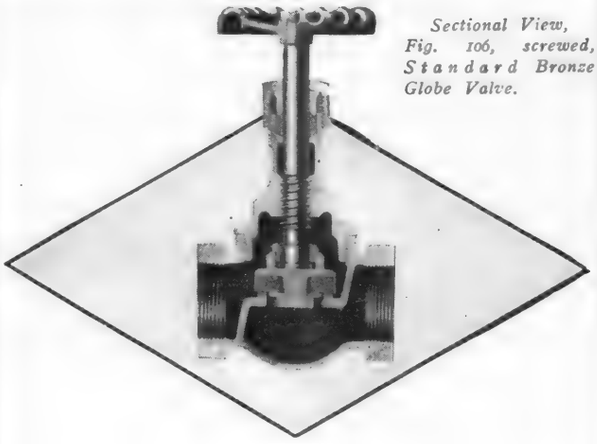
Elliott Co., Jeannette, Pa.
Please send me a copy of your Bulletin N-5 entitled "Water—But No Corrosion."

Name .....

Company .....

Address .....

N-830a



Sectional View, Fig. 106, screwed, Standard Bronze Globe Valve.

VALVES that do you justice

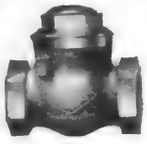


Fig. 352, screwed, Standard Bronze Swing Check Valve.

Fig. 110, screwed, Standard Bronze Cross Valve.

Fig. 143, screwed, Standard Iron Body Angle Valve.

Owners invariably link the name of the contractor with the performance of the equipment he installs. If trouble develops, the responsibility may be placed on the contractor no matter where the real fault lies.

Jenkins Valves can be relied on to do justice to you, and to the quality of your work. Made for the maximum service not merely the average, these sturdy valves are unaffected by the many strains of heating and plumbing service—expansion and contraction, or lifting and settling of pipe.

Only a genuine Jenkins valve gives Jenkins service, and to be a genuine Jenkins, a valve must bear the Jenkins "Diamond" mark. See it on every valve you install.

JENKINS BROS.
80 White St.....New York, N. Y.
524 Atlantic Ave.....Boston, Mass.
133 No. Seventh St.....Philadelphia, Pa.
646 Washington Blvd.....Chicago, Ill.

JENKINS BROS., LIMITED
Montreal, Canada London, England

Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

LAVIGNE

GRADUATED PACKLESS STEAM RADIATOR VALVES

Built Right To Stay Tight

THE manufactures of Lavigne Packless Steam Radiator Valves have never made extravagant claims for their product. They merely ask you to compare their valve with others and draw your own conclusions.

They do not join in the chorus by proclaiming: "Ours is the best valve in the World." Yet they sincerely believe that, point for point, Lavigne Packless Valves offer the greatest value of any line on the market.

This belief seems to born out by the confidence of customers who have consistently held to these valves over a long period of years.

Also manufactures of a complete line of high grade steam and Hot Water Radiator Valves in all standard sizes and patterns.

Your jobber can supply you.

COMMONWEALTH BRASS CORPORATION
DETROIT
NEW YORK SAN FRANCISCO CHICAGO

ADSCO HEATING

Has Proved Economical In the Chambers Building

The Adsco Graduated Packless Radiator Valve Controls steam as a faucet controls water.

HERE are 750,000 cubic feet of space kept comfortable by 14,566 square feet of direct radiation.

There's no need to waste steam through overheating rooms because it is controlled at each radiator, like water at a faucet, by an Adsco Valve.

Adsco Heating is equally economical for small residences, apartment houses, stores, warehouses, factories. It is easily installed, for no complicated devices are needed. Hot water systems are easily changed over to Adsco Heating.

Write for Folder No. A-53-H.

Chambers Bldg., Kansas City, Mo. Adsco Heating, using steam furnished from underground distribution mains of the Kansas City Power & Light Co.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.

Offices:
NEW YORK CHICAGO SEATTLE

If interested in heating a group of buildings from a central steam generating station, ask for booklet No. 20-H.

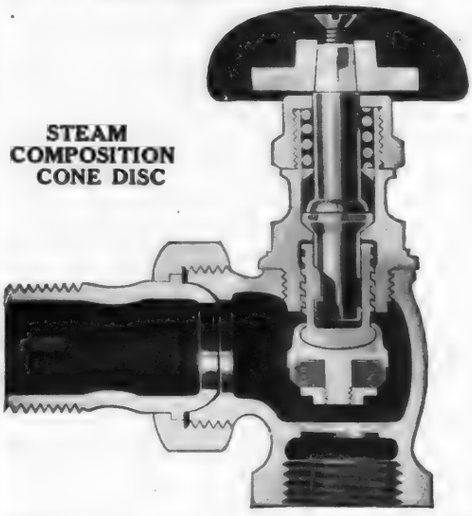
ADSCO HEATING

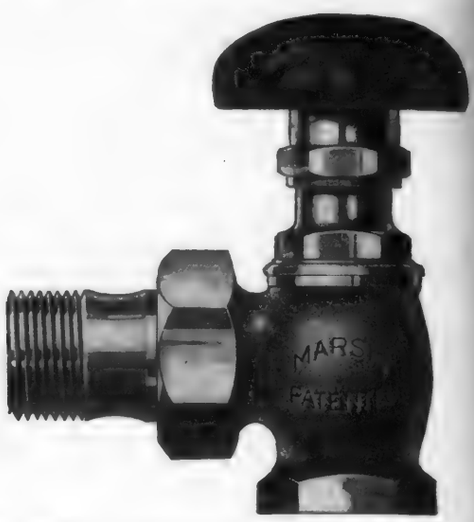
Marsh Re-enforced Packless Cone Disc Radiator Valves

AGAIN: Something new and an improvement in Radiator Valve Discs.

Marsh Re-enforced Packless **Reversible Cone Disc** Radiator Valves are a FURTHER IMPROVEMENT in valve construction.

The **Marsh Cone Disc** is of special steam composition and **will outwear** and **give superior service** to a flat disc for **three reasons:**



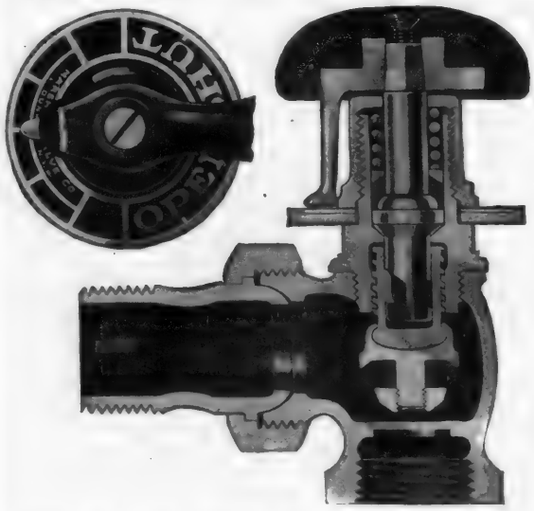


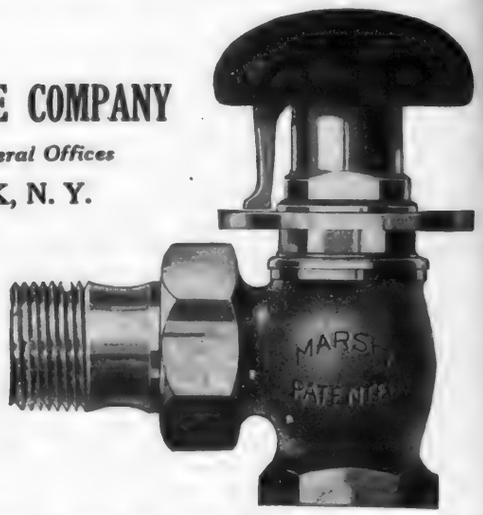
FIRST: Through design of disc and protection afforded from disc nut covering under surface they will not warp and crack as will a flat disc which overhangs valve seat.

SECOND: The compression is at right angles to face of seat, forcing disc compound inward to center, making disc more compact and harder instead of scoring and extruding over seat, opening cracks or seams if any, as with a flat disc.

THIRD: The beveled seat is low in valve body, giving perfect drainage and will wash free from sand or scale in system, positively providing against leakage through scale or grit imbedding in disc as is common with a raised flat seat and flat disc construction.

Marsh Re-enforced Modulated Cone Disc Radiator Valves





MARSH VALVE COMPANY

Plant and General Offices

DUNKIRK, N. Y.

With this *Oval Wheel Handle* you have the same dial and indicator control as with Lever handle and a *much stronger* and *more serviceable CONSTRUCTION* than is possible with a Wood wheel as *this composition won't break or split as will wood.*

FURTHER, this handle is removable and interchangeable with our Lever handle, effecting a material advantage to customer in matter of convenience of changing from one to the other on job if for any reason change is desired.

IMPORTANT: These cone disc valves cost but very little more than our regular Packless hot water valves *and meet competition packed valve costs with a strictly high-grade GUARANTEED packless valve for Apartment House operation or any class of work.*

Positive Heat Insurance
and Temperature Control

Dole PACKLESS
RADIATOR VALVES

Install DOLE Ball-Bearing Packless Radiator Valves

and experience that feeling of satisfaction in knowing that you have the best the market affords.

Manufactured by

THE DOLE VALVE COMPANY, 1923-33 Carroll Ave., CHICAGO

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Any standard Trane Bellows Trap will respond to this simple test for sensitiveness. The next time you see a Trane representative ask him to give you a demonstration, or, if you prefer, we will gladly loan you a cut-open trap with the radiator attachment shown here and you can perform the test yourself.

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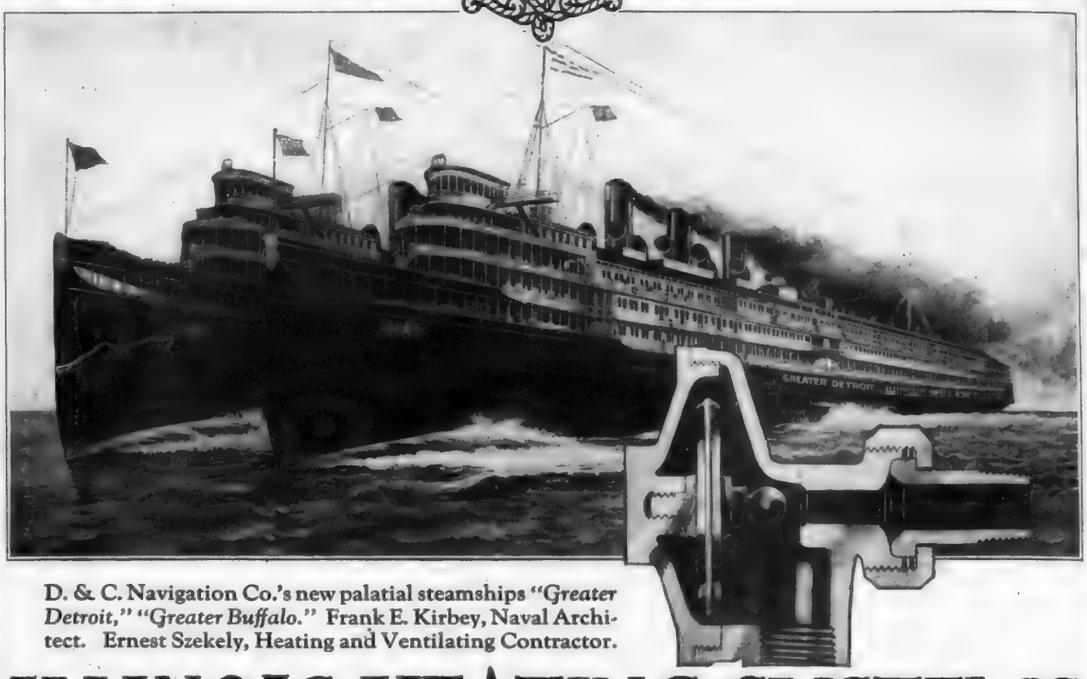

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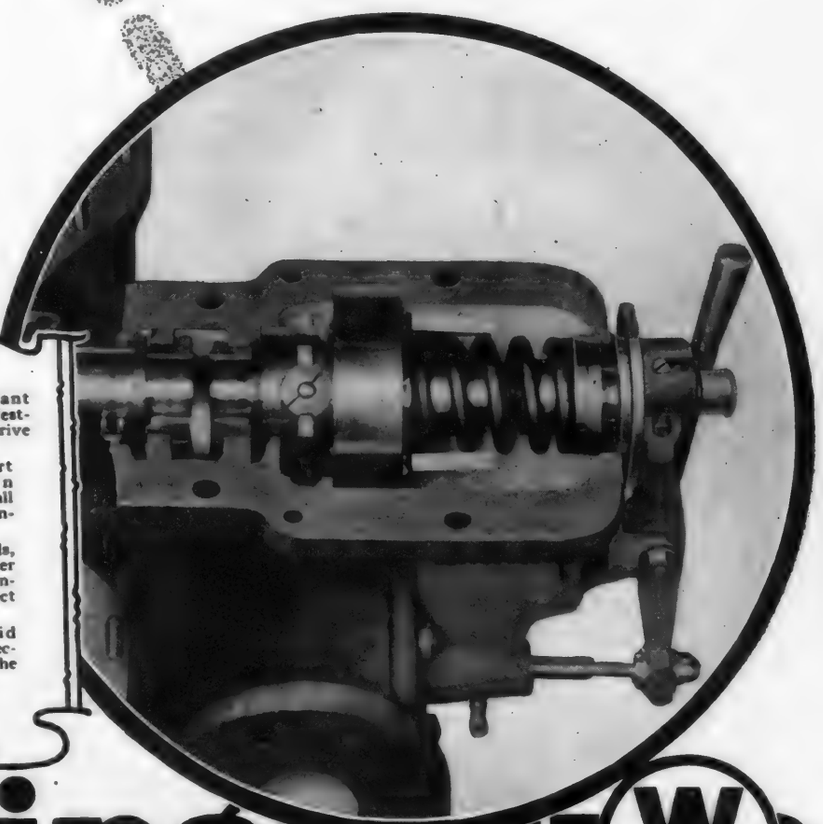

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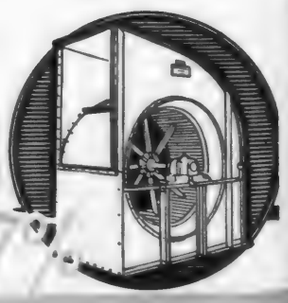

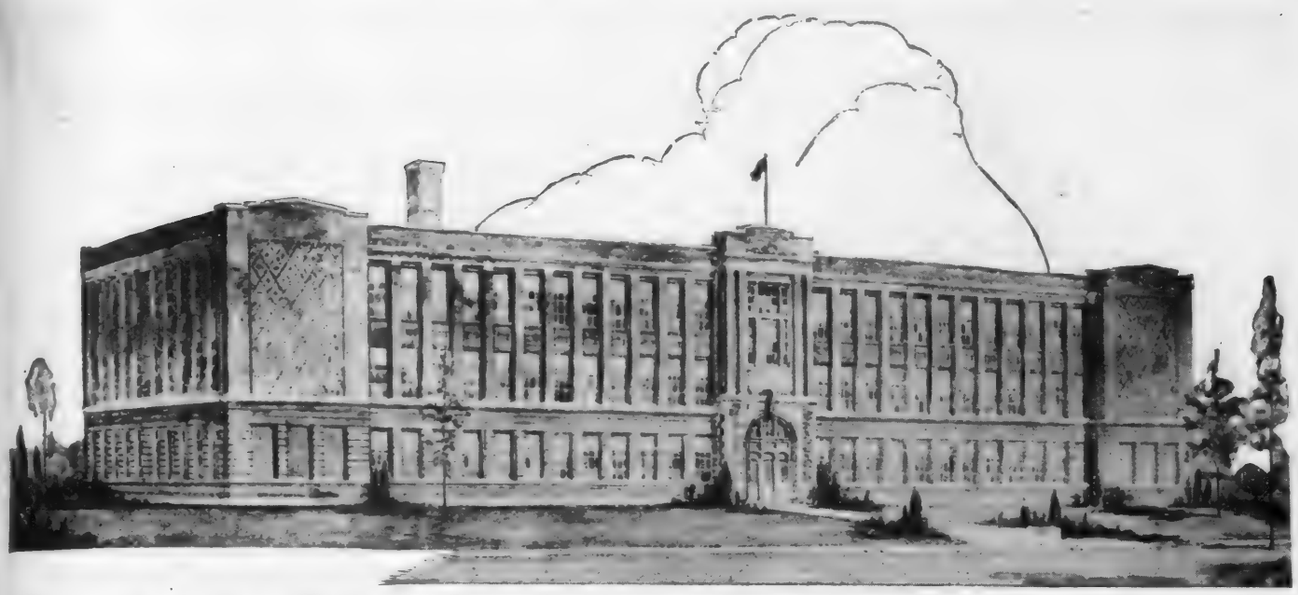

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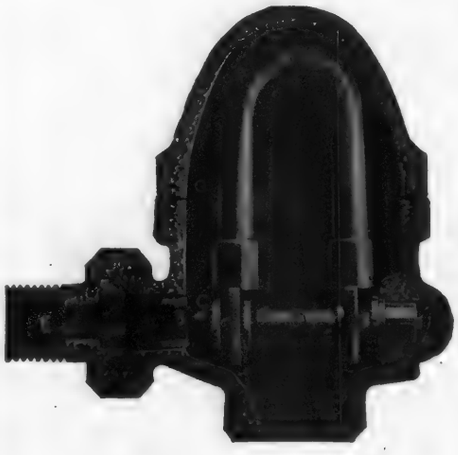

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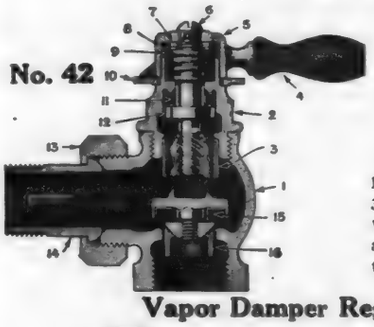


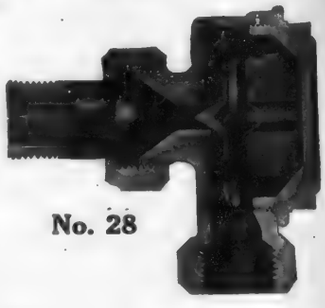
No. 42

Packless Radiator Valves

Quick-opening, nickel-plated brass body. Fig. 38, angle pattern, wood wheel handle; Fig. 42, angle pattern, graduating type, lever handle.

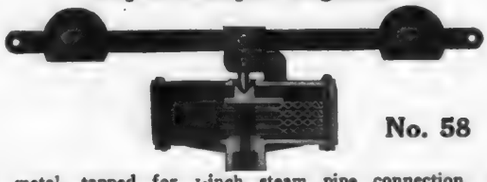
Radiator Traps

Discharge air and water in large quantities. Close tight against steam. Noiseless in operation. Nos. 28 and 28-A of steam metal, furnished N. P. unless otherwise specified. Nos. 28-A and 29-A have right and left-hand discharge openings. Nos. 29, 29-A, 33, 34 and 36 have iron bodies and brass caps, furnished plain unless otherwise specified.



No. 28

Vapor Damper Regulators



No. 58

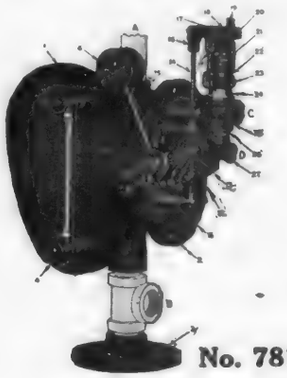
All metal, tapped for 1-inch steam pipe connection. Shipped complete with lever and two weights, S hooks, 2 ceiling pulleys and 12 feet of No. 10 plumbers' chain.

No. 56 for 0 to 3 pounds pressure, constructed with bellows of 10-inch flexible walls. No. 58 for 1 to 15 pounds pressure, constructed with bellows of 6-inch flexible walls.

Combination Float and Thermostatic Ball Check Valves

For venting supply and return mains of heating systems. These air valves close tight against water and steam, and by use of the check prevent the atmospheric pressure from entering the discharge opening.

No. 15



No. 781

Air Eliminator and Return Traps

For automatically returning the water of condensation direct to boiler and discharging air. Minimum distance between water line of boiler and bottom of trap should be 18 inches. "A"—inlet to trap; "B"—discharge to boiler; "C"—steam connection to boiler; "D"—air vent.

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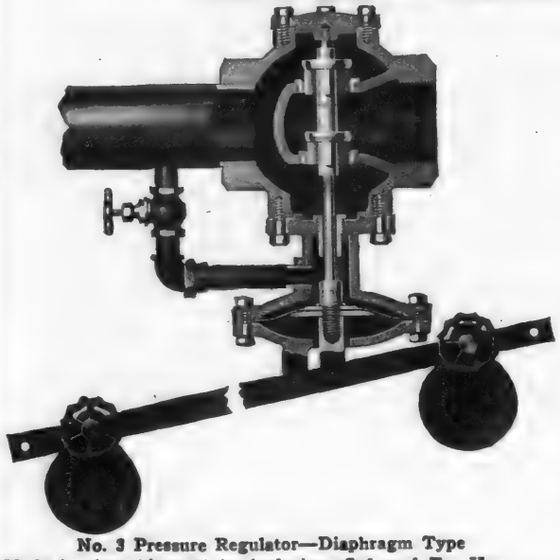
SIMPLE — RUGGED — DIRECT ACTING



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Made in sizes ¾ to 14 in. inclusive—Std. and Ex. Hvy.
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Sizes 2 to 6 in. inclusive made with iron bodies—screwed or flanged ends.
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Also made with expanded outlets.

No. 3 Pressure Regulators (Diaphragm Type) are intended for use in connection with vacuum, atmospheric, and low pressure heating systems. They can also be used for the control of air, water or gas.

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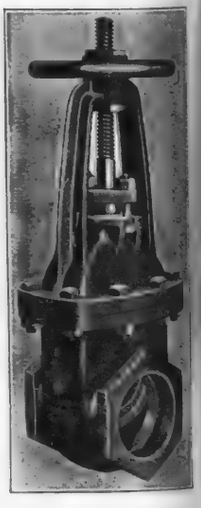
SCREWED, FLANGED AND HUB END STYLES

NON-RISING STEM AND O. S. and Y. PATTERNS



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The figures below proved to the engineers of the New York Central Railroad Co. that the Allen Air-Turbines on one of their sub-stations are capable of doing more than we claim for them.

Diameter of Air-Turbine Used 48 Inches	AIR DISPLACEMENT—CU. FT. PER HOUR		
	Wind Velocity 4 Miles per Hour	Wind Velocity 6 Miles per Hour	Wind Velocity 8 Miles per Hour
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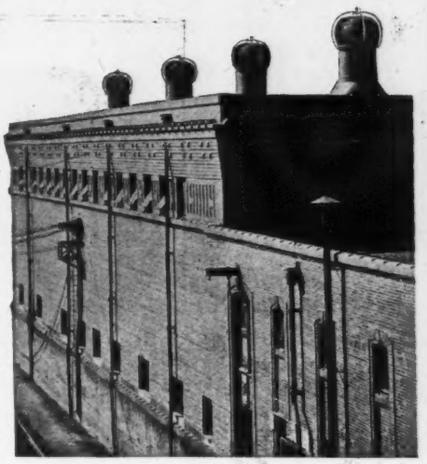

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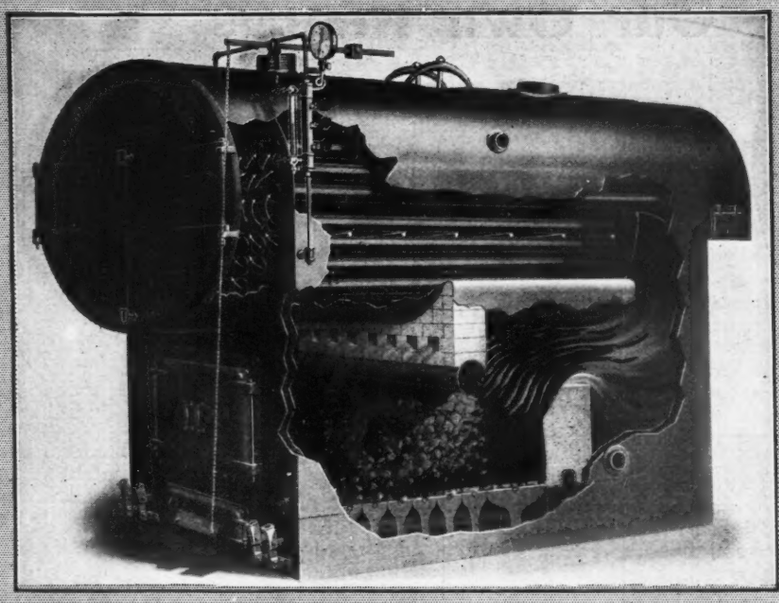
Vapor and Vacuum Heating Systems

A change of name only



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The Heating and Ventilating Magazine

Vol. XXII No. 3

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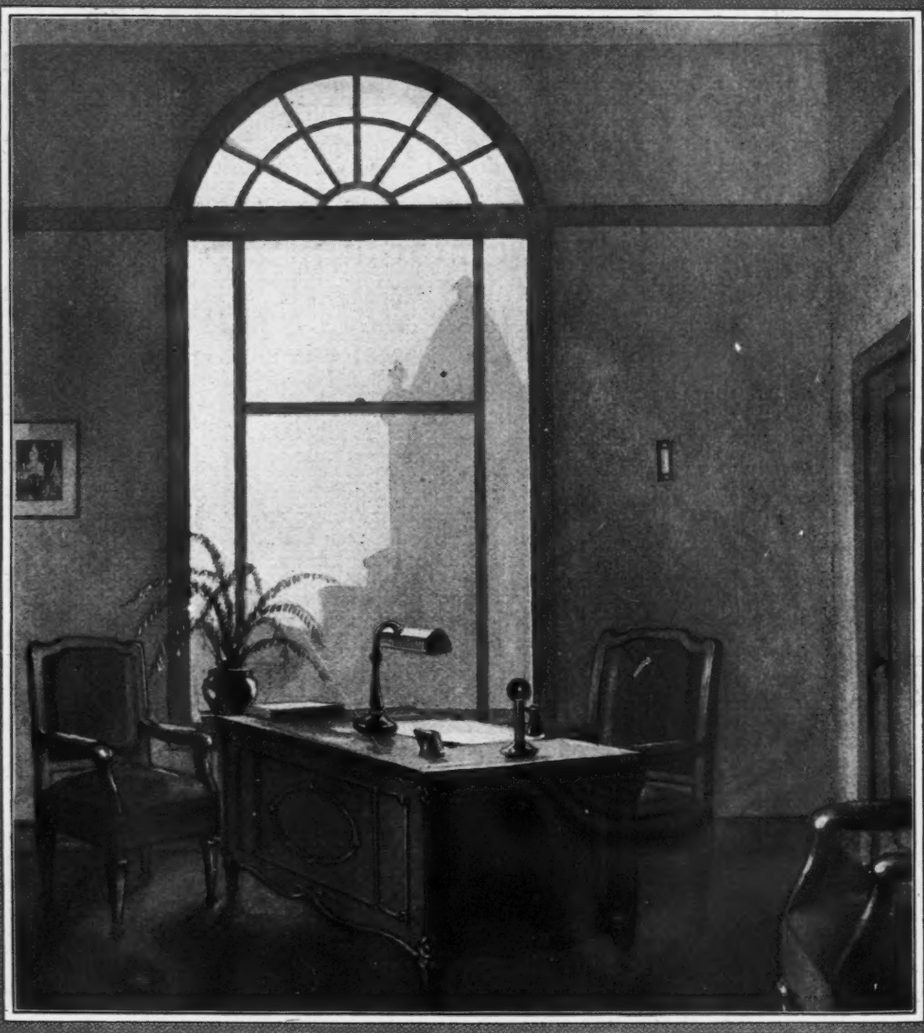

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The Johnson Pneumatic System of Temperature Regulation is an invaluable asset to the business building, a blessing to the home. The fuel saving of as much as 50 per cent, which it effects, prompts sound efficiency judgment to endorse its installation. The exactness of correct temperature in each room, separately, which it maintains, commends it highly as an essential comfort, convenience and health accessory. The extreme perfection which The Johnson has attained is the final decisive point.

JOHNSON SERVICE COMPANY, MILWAUKEE

AUTOMATIC TEMPERATURE REGULATION FOR 38 YEARS

TWENTY-EIGHT BRANCHES UNITED STATES AND CANADA

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